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ROYAL COMMISSION

ON

ENERGY

HEARINGS

HELD AT

CALGARY,

ALTA.

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ROYAL COMMISSION

ON

ENERGY

Hearings held at Calgary,
commencing Monday, February
3, 1958, at 10.00 A.M.

PRESENT:

Mr. H. Borden, C.M.G., Q.C.	--	Chairman
Mr. J.L. Levesque,	--	Member
Mr. G.E. Britnell,	--	Member
Mr. G.G. Cushing,	--	Member
Mr. R.D. Howland,	--	Member
Mr. L.J. Ladner, Q.C.	--	Member
Dr. R.M. Hardy,	--	Member

COMMISSION COUNSEL:

Mr. A.S. Pattillo, Q.C.	
Mr. Miles H. Patterson.	
Mr. J.F. Parkinson	-- Secretary to the Commission.
Major N. Lafrance	-- Assistant Secretary to the Commission.



APPEARANCES:

- Mr. J.J. Frawley,
representing The Province of Alberta.
- Mr. S.J. Helman and
Mr. E. Bredin,
representing the City of Calgary.
- Mr. N.A. Macleod,
representing The Oil and Gas Conserva-
tion Board of the Province of Alberta.
- Mr. G.H. Steer,
representing The Canadian Western
Natural Gas Company Limited, Calgary;
and North-Western Utilities Limited,
Edmonton.
- Mr. R.A. MacKimmie,
representing Alberta & Southern Gas
Company Limited.
- Mr. N.J. McNeill and
Mr. F.P. Layton,
representing Trans-Canada Pipe Lines
Limited.
- Mr. E.J. Chambers,
representing Westcoast Transmission
Company Limited and Northern Natural
Gas Company.
- Mr. S.D. Turner,
representing Canadian Petroleum Associa-
tion.
- Mr. W.A. Howard,
representing Alberta Gas Pipe Line Com-
pany.
- Mr. J.E. Gifford,
representing the Government of Saskatchewan.
- Mr. D.M.M. Goldie,
representing The British Columbia Electric
Company Limited.
- Mr. Robert E. Lee Paul,
representing The National Coal Association,
Washington.



THE CHAIRMAN: I declare this hearing open and I invite the Secretary to read the Order in Council defining the Terms of Reference.

MR. PARKINSON: P. C. 1957-1386. Certified to be a true copy of a Minute of a Meeting of the Committee of the Privy Council, approved by His Excellency the Governor General on the 15th October, 1957.

The Committee of the Privy Council have had before them a report from the Right Honourable John Diefenbaker, the Prime Minister, representing:

That, inasmuch as Canada has within its boundaries large sources of energy in the form of gas, oil, coal, water and uranium, the increasing need of energy for the growing industrial requirements of Canada renders it of the greatest importance to assure the most effective use of those resources in the public interest;

That it is desirable that an investigation be made now into a number of questions relating to sources of energy in order to assist in determining the principles and procedures to be applied in the administration of certain aspects of energy policy which fall within the jurisdiction of the Parliament of Canada; and

That it is desirable that a suitable form of organization be devised to ensure that present and future Canadian requirements for energy are taken fully and systematically into account in



granting licences for the export of energy or sources of energy.

The Committee, therefore, on the recommendation of the Prime Minister, advise that:

Henry Borden, Esquire, C.M.G., J.C., of the
City of Toronto.

J. Louis Levesque, Esquire, of the City of Montreal

George Edwin Britnell, Esquire, of the City of
Saskatoon,

Gordon G. Cushing, Esquire, of the City of Ottawa,

Robert D. Howland, Esquire, of the City of
Halifax, and

Leon J. Ladner, Esquire, J.C., of the City of
Vancouver

be appointed Commissioners under Part I of the Inquiries Act, to enquire into and make recommendations concerning:

- (a) The policies which will best serve the national interest in relation to the export of energy and sources of energy from Canada;
- (b) the problems involved in, and the policies which ought to be applied to, the regulation of the transmission of oil and natural gas between provinces or from Canada to another country, including but without limiting the generality of the foregoing, the regulation of prices of rates to be charged or paid.



- the financial structure and control of pipeline corporations in relation to the setting of proper prices or charges, and all such other matters as it is necessary to enquire into and report upon, in order to ensure the efficient and economical operation of pipelines in the national interest;
- (c) the extent of authority that might best be conferred on a National Energy Board to administer, subject to the control and authority of parliament, such aspects of energy policy coming within the jurisdiction of Parliament as it may be desirable to entrust to such a Board, together with the character of administration and procedure that might best be established for such a Board;
- (d) whether, in view of its special relationship to the Northern Ontario Pipeline Crown Corporation and the nature of its financing and control, any special measures need be taken in relation to Trans-Canada Pipe Lines, Limited in order to safeguard the interests of Canadian producers or consumers of gas; and
- (e) such other related matters as the Commissioners consider it necessary to include in reporting upon those specified above.



The Committee further advise:

1. That the establishment of the Commission and the conduct of its enquiry shall not in any way delay or postpone the continuation of negotiations or of consideration, whether within the International Joint Commission or otherwise, relating to waters crossing the international boundary and the development of electric energy therefrom in the best interests of Canada, or any other matter coming within the jurisdiction of the International Joint Commission, but the Commissioners may comment or report upon any aspects of these matters and of policy relating thereto that they consider to be relevant to the questions referred to them;

2. That the Commissioners be authorized to exercise all the powers conferred upon them by section 11 of the Inquiries Act and be assisted to the fullest extent by government departments and agencies;

3. That the Commissioners adopt such procedure and methods as they may from time to time deem expedient for the proper conduct of the enquiry and sit at such times and at such places in Canada as they may decide from time to time;

4. That the Commissioners be authorized to engage the services of such counsel, staff and technical advisers as they may require at rates of remuneration and reimbursement to be approved by the Treasury Board;



5. That the Commissioners report to the Governor in Council; and

6. That Mr. Henry Borden be Chairman of the Commission.

R. B. Bryce,

Clerk of the Privy Council.

And so, Mr. Chairman, I hereby table this Order in Council and at the same time I would like to table the Commission under the Great Seal of Canada appointing Henry Borden and others as Commissioners under Part I of the Inquiries Act to inquire into the export of energy and sources of energy from Canada. At the same time, Mr. Chairman, I would like to formally table another Order in Council dated the 13th of January, 1958, which I will read.

The Committee of the Privy Council, on the recommendation of the Right Honourable John George Diefenbaker, the Prime Minister, advise that Dr. R. M. Hardy, Dean of the Faculty of Engineering of the University of Alberta, be appointed a member of the Commission appointed under the Inquiries Act, pursuant to Order in Council P.C. 1957-1386 of 15th October, 1957 (Energy Policies).

(Sgd) R. B. Bryce,

Clerk of the Privy Council.

Finally, Mr. Chairman, I would like to table two Orders in Council: one appointing a



secretary of this Royal Commission and the other appointing an Assistant Secretary of this Royal Commission.

P.C. 1957-1473. The Committee of the Privy Council, on the recommendation of the Right Honourable John George Diefenbaker, the Prime Minister advise that Joseph Frederick Parkinson, Economic Adviser, Department of Finance be appointed Secretary of the Royal Commission constituted by Order in Council P.S. 1957-1386 of 15th October, 1957 (Energy Policies).

(Sgd) R. B. Bryce

Clerk of the Privy Council.

P.C. 1957-1574. The Committee of the Privy Council, on the recommendation of the Right Honourable John George Diefenbaker, the Prime Minister, advise that Major N. Lafrance, of Ottawa, be appointed Assistant Secretary of the Royal Commission constituted by Order in Council P.C.1957-1386 of 15th October, 1957 (Energy Policies).

(S d) A. M. Hill

Asst. Clerk of the Privy Council.

THE CHAIRMAN: Thank you very much, Mr. Parkinson.

Gentlemen, before proceeding with the hearing this morning which is the submission by the Department of Mines and Minerals of the Government of Alberta I would like to say how honoured the Commission is by the presence here this morning of



the Premier of the Province, Mr. Manning, and other distinguished members of the Government, and citizens. We are very happy to be able to start our proceedings in Calgary; we are doing that as announced because the Commission feels that the oil and gas industry is one to which it should apply itself first. We have received excellent cooperation, sir, from your Government, from officials in all strata and also from the Petroleum Association and from all organizations and the industry itself. I trust that co-operation will continue. This is not a trial, this is not an inquisition; we hope to conduct our hearings with dignity and fairness and without fear or favour.

With that, sir, I believe you desire to say a few words to us.

HONOURABLE E. C. MANNING (Premier of Alberta): May I at the outset extend to you a most cordial welcome to the Province of Alberta and express the satisfaction we feel at your choice of this province as the starting point of your important enquiry into the energy resources of Canada.

To appraise the energy resources of this vast nation and recommend policies intended to ensure their development and use in the best interests of the Canadian people is an undertaking of the first magnitude and one fraught with tremendous responsibility. In no other area of Canada is this fact more fully appreciated than in this province where the development of energy



resources has become a major factor in our provincial economy.

We occupy the unique position of having within our boundaries a predominant share of three of Canada's major sources of energy, i.e. coal, oil and natural gas.

In recent years our coal industry has suffered the adverse effects of competitive fuels and much of the market that existed previously for Alberta coal has been lost to oil and natural gas. Our coal resources, which are almost half of Canada's total reserves, still remain a vast reserve source of energy awaiting further technological advances to bring their full utilization back into the realm of economic feasibility.

The development of our oil resources in the past ten years has attained national importance and has resulted in over 8,000 producing wells with a permissible daily production in excess of 780,000 barrels. The current rate of actual production is less than 45 per cent of permissible production due entirely to lack of adequate markets.



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The two major factors responsible for this situation are: first, the competition of foreign crude and finished products in the unprotected eastern Canadian refining and marketing areas, and second, United States import restrictions which have created uncertainty prejudicial to plans to supply Canadian crude to United States refineries and have reduced the volume of Alberta crude entering United States markets.

An equally serious situation prevails with respect to natural gas. During the course of your hearings evidence will be submitted indicating the extent of Alberta's proven and potential deliverable reserves. That evidence will, I am sure, establish the fact that we have in this province reserves of natural gas far in excess of all present and future local requirements. Lack of markets for this valuable source of energy currently is immobilizing millions of dollars of investment capital already spent in drilling wells which are now capped. This situation, together with the prevailing uncertainty as to future Federal Government policy with respect to export markets, is seriously discouraging further exploration and development with resultant adverse effects on the industry and on the provincial and national economy.

In the light of these circumstances, a clearly defined national policy with respect to



both domestic and export markets is of the utmost importance and, in our opinion, a matter of urgency. For this reason, we hope the findings and recommendations of your Commission with respect to this particular phase of your studies will be completed at the earliest possible date.

The current situation may be summarized as follows:

1. The substantial development which has taken place in the past ten years, while only a small fraction of the potential, has established deliverable reserves of crude oil sufficient to meet total Canadian requirements and reserves of natural gas far in excess of what can be absorbed by all present and future local markets.
2. It is of major importance to the economy of this province and in the interests of Canada as a nation that a vigorous program for the progressive exploration and orderly development of these resources be maintained.
3. The rate and extent of further exploration and development depends primarily on the measure of incentive created by the ability of producers to market their products at reasonable rates of return and in sufficient volume to make their operations economically feasible.
4. The current market situation and outlook for the reasons I have indicated offers very little incentive and consequently is holding back



exploration and development to the detriment of the economy of this province and the nation as a whole.

The nature of the problem is such that barring an international emergency that would quickly change the entire picture with respect to continental oil supply it cannot be solved in the foreseeable future without important policy decisions at Federal Government level. For these reasons the findings and recommendations of your Commission will be of particular importance and concern to the people of this province. We earnestly desire to assist you in every way possible in the discharge of your onerous duties and responsibilities. To this end, the Department of Mines and Minerals and the Oil and Gas Conservation Board have prepared a number of submissions which will be presented for the purpose of acquainting your Commission not only with pertinent background information but with factual data concerning the various phases of exploration, development and marketing of Alberta's oil and gas resources. I am confident all branches of the industry and other bodies, both public and private, likewise will extend to you a full measure of co-operation and assistance.

At a later date, we would like to make a formal submission, setting out the Government's views with respect to various policy matters included in your terms of reference.



May I further advise that we have named Mr. J.J. Frawley, Q.C., Provincial Government Counsel at Ottawa, to represent the Government of Alberta at the hearings of the Commission and I would ask that you, sir, or Mr. Pattillo or Mr. Parkinson confer with Mr. Frawley at any time you feel the Government or any of its departments can be of assistance or facilitate in any way the important work you have undertaken.

THE CHAIRMAN: Thank you very, very much, Mr. Manning. I am sure it will be most helpful to the Commission to have, and it is very good of the Government to put at our disposal, the advice and assistance of Mr. Frawley, who is so well-known to us. We are also pleased to hear that you propose at a later date to make submissions with respect to various policy matters. That will be very welcome, and we shall look forward to receiving it, sir, at the convenience of yourself and those concerned. And, I want to express our appreciation of your very kind words of welcome.

MR. PATTILLO: Mr. Chairman and gentlemen of the Commission, may I at this opening session, and for the benefit of many who are here today, advise that I have been appointed as Counsel for the Commission, and I have with me Mr. Miles Patterson of Calgary. The Commission, in addition, has appointed Dr. Hearn as the Chief Engineering Advisor to the Commission, Dr. Campbell Sproule



as the Advisor in geology and related matters, and Mr. Bruce West as the Financial Advisor. From time to time it is intended that there be additional persons appointed to advise the Commission on various phases of the inquiry.

Mr. Chairman, may I make a suggestion to the Commission as to the procedure which Mr. Patterson and I recommend be followed in the hearings which are now commencing, and in other hearings which will be held in other Provinces of Canada.

We recommend that in every instance notice be given in the newspapers, as it has been done in regard to these hearings, of the hearing, the place and time, and the nature of the matters to be inquired into, and that in each Province, as we have done in this Province at this time, we arrange for a place of deposit where briefs to be submitted to the Commission may be filed in advance of the hearings. We suggest that 25 copies of each brief be filed in order that there will be sufficient for the Commission, the officers, and for inspection by others.

As to the inspection, in order to facilitate the hearings we recommend that the briefs filed be permitted to be inspected by any person who is filing a brief. The purpose of this inspection is to enable the person who is filing a brief to see what is going to be put forward by some other company, and to make preparation for



questioning in regard to anything contained therein with which he does not agree.

It is our proposal that at the time of the filing of the briefs, which should be done -- of course, this cannot be followed out for these hearings because of the speed in which they were brought on, but in future we think that the briefs should be filed ten days before the commencement of the hearings, and that at the time the names of the witnesses who will be put forward by the person filing the brief to support the documents and data contained therein should also be filed, giving a brief summary of who the witness is, where he comes from, his qualifications, and that part of the brief which he is prepared to support.

We recommend, Mr. Chairman, that at the hearings the briefs be read in order that they may become part of the record. In some instances, we will suggest that the briefs need not be read in full, particularly if they cover matter which has already been dealt with by previous witnesses, but in that event we suggest that the briefs be taken as read in order that they may be copied in full into the record of the proceedings.

We suggest that any person acting for the company be permitted to read the brief, but that once that has been concluded then the witnesses whose names have been given to us must be prepared to submit themselves, in the first instance, for an



examination for discovery by either Mr. Patterson or myself, and that following that, in the case of the present hearings, they will be cross-examined by counsel for the Province and cross-examined by counsel for any municipality appearing. So far as the cross-examination by the municipality is concerned we recommend that his cross-examination be confined to the subject matters which are of vital importance to the municipality.

There are many counsel here today -- and I hope in a few minutes to ask them to give their names and who they are representing. Any counsel representing any person who has business before this Commission is entitled to submit to Mr. Patterson and myself any questions which they think should be put to the witness. We will decide whether or not the question is proper and should be put, and if it is just one or two questions we recommend that we put them. On the other hand, if counsel wishes to cross-examine on a particular subject matter we suggest that we could speed matters up if they were permitted to do so, but it must be understood what the subject matter is, and the cross-examination must be confined to that subject matter. It is assumed that counsel will be here representing the witnesses, and they, of course, we suggest, should have the right of re-examination, and that having concluded the re-examination that then the Commissioners, who will undoubtedly have



questions to ask, should ask the questions which they wish to bring out. We feel that if the Commissioners can wait until that time, we can have a more clear record, and one which will be much easier to read than if there are interruptions during the examination.

As to the appearances, as the Secretary read out in the terms of reference, the Commission, under the Public Inquiries Act, has the power to subpoena. We are hoping that it will be unnecessary to use that power, and so far we have had the utmost co-operation, and people have come forward voluntarily, but I think, Mr Chairman, it should be pointed out to everyone that in the interests of getting the complete factual story, if witnesses do not come forward voluntarily, we recommend that the Commission exercise the power of subpoena which they have.

We recommend that in the taking of evidence we do not require the witnesses to be sworn excepting when we are dealing with the Trans-Canada Pipe Lines problem to which particular reference has been made in the terms of reference. On the other hand, we again suggest to you, sir, that if witnesses are not co-operating then we reserve the right to put the witness under oath.



Now, sir, may I just say a few words about these present sittings which we are commencing here at Calgary. Notice was published in the newspapers about the middle of the month and I am proposing that such notices be filed as part of the record. The notice stated, generally, the subject matter of this inquiry. We do not intend at this time and during these present hearings to try and cover the whole of the field of gas and oil, but we do intend to try to go into the background material and the history, the production, the present markets, the transmission problems, and we intend, in a preliminary way, to at least inquire into the financial structure of the pipe line companies.

We have prepared, and I think everybody has obtained, a syllabus of what we hope to do at this hearing.

Now, in commencing today we propose -- before I go on to that, Mr. Chairman, may I just suggest this: we are recommending that the hearings commence at ten o'clock in the morning and continue until twelve-thirty, with a break in the morning, and that they resume at two o'clock and continue until four-thirty, with a break in the afternoon.

We have prepared, and Mr. Patterson will make available to anybody who wants to obtain the information, a tentative time table as to when we anticipate various companies will be reached, and I suggest, Mr. Chairman, that we assure each of these



companies that even if it means that we may have to adjourn for a short interval, we will not attempt to call them until the time that we have told them that they should be ready to go on. It may be that they will have to wait because of our incorrect estimates as to time, but I suggest that because of the difficulties of bringing expert witnesses and other witnesses, that we should not require them to go on prior to the date which we have notified them would be their starting time.

Now, before I ask for the appearances here today, for the purpose of the record, I think I should say, Mr. Chairman, that for the first few days of these hearings a lot of information which will be brought out and which will be put on the record will be very familiar to those who are in the industry and who are making their livelihood therein, and it may be rather dull and they may consider it unnecessary; but in order to prepare a full factual picture, which I conceive, as counsel, it is the duty of counsel to do for you and the other members of the Commission, I have decided it is necessary that we put this background material on the record.

Mr. Chairman, I think that is everything I would like to say at this stage and, if you would agree, you and the other members of the Commission would agree with the procedure which I have outlined, then we can assume that that procedure will be in



force at this and other hearings and then we can ask for the appearances of counsel.

THE CHAIRMAN: I think, Mr. Pattillo, the members of the Commission, in principle, agree with everything you have outlined, which has been a matter of some discussion. I would like you to clarify one point, if you would: it is not the intention of counsel to examine Government organizations and associations. They may ask questions to elucidate and get explanation of certain information in the brief and opinion evidence and that sort of thing. Am I correct in that?

MR. PATTILLO: That is quite correct, Mr. Chairman, and I thank you for bringing that omission to my attention.

Perhaps we could now obtain the appearances, starting with you, Mr. Frawley, and going down to the end of the table and then starting at this end and going down again.

MR. FRAWLEY: My name is J. J. Frawley. I appear for the Province of Alberta.

MR. HELMAN: My name is S. J. Helman and, together with Mr. Bredin, who is not here today, and I represent the City of Calgary.

MR. MACLEOD: My name is N. A. Macleod and I appear for the Oil and Gas Conservation Board of the Province of Alberta.

MR. STEER: My name is G. H. Steer, sir, and I am appearing for the Canadian Western Natural



Gas Company Limited of Calgary and the North-Western Utilities Limited, of Edmonton.

MR. MacKIMMIE: I am R. A. MacKimmie, Mr. Chairman, and I appear for the Alberta & Southern Gas Company Limited.

MR. McNEILL: My name, Mr. Chairman, is N. J. McNeill, and Mr. F. P. Layton is with me, appearing for the Trans-Canada Pipe Lines Limited.

MR. CHAMBERS: E. J. Chambers, Mr. Chairman, the Westcoast Transmission Company Limited and also Northern Natural Gas Company.

THE CHAIRMAN: Thank you.

MR. TURNER: S. D. Turner, Mr. Chairman, appearing for the Canadian Petroleum Association.

MR. HOWARD: W. A. Howard, Mr. Chairman, appearing for the Alberta Gas Pipe Line Company.

MR. GIFFORD: J. M. Gifford, for the Government of Saskatchewan, here as observers only at this time.

MR. GOLDIE: D. M. M. Goldie, Mr. Chairman, appearing for the British Columbia Electric Company Limited.

THE CHAIRMAN: Well, we seem to have a goodly cross-section of able counsel across the country. Are there any further counsel?

MR. PAUL: Mr. Chairman, I am Robert E. Lee Paul, appearing for the National Coal Association in Washington. I would like, either now or at some other appropriate time, to address the question either



to the Commission or Commission counsel whether a statement would be acceptable from us, touching upon the matters of the proposed export to the United States.

THE CHAIRMAN: The proposed -- I beg your pardon, sir; I did not catch that. The proposed what?

MR. PAUL: Relating to the matters touching upon proposed exports to the United States of gas.

THE CHAIRMAN: Oh, yes.

MR. PAUL: Limited to that question.

THE CHAIRMAN: Would you discuss that, sir, with Mr. Patterson and Mr. Pattillo, later in the day?

MR. PAUL: Yes, sir.

THE CHAIRMAN: Thank you very much. Are there any other counsel present who have decided to declare themselves?

MR. MacKIMMIE: Mr. Chairman, I wonder if, before the proceedings start, I might be advised whether or not different interests and parties might obtain transcripts of the evidence that is being taken in these proceedings?

THE CHAIRMAN: I think, sir, that that has been covered. The Secretary, Mr. Parkinson, and Mr. Pattillo can give you the answer immediately on that.

MR. PARKINSON: We are hoping that we have an adequate system of court reporting going on and



that people concerned might get in touch with the court reporters here to obtain a transcript. I may say the cost will be moderate.

MR. TURNER: Mr. Chairman, I would like to point out we expect a number of the companies will be submitting briefs. They do not appear to be represented by counsel this morning but they will be at a later date and I suppose that will be satisfactory?

THE CHAIRMAN: Oh, this is not an exclusive roster of counsel to appear before the Commission, I am sure. I understand exactly what you mean.

MR. PATTILLO: Mr. Chairman, before calling the first witness, who will read the brief of the Department of Mines and Minerals of this Province, I intended to state that Mr. Patterson and I are suggesting that our exhibits be marked in this manner, that they have a code letter C, indicating the hearing is at Calgary, followed by a number which will indicate the day of the month -- for example, today, "3" followed by the number of the exhibit filed in that day, so that the exhibits today will read "C-3-1" and "C-3-2" and so on, and the exhibits of tomorrow will read "C-4-1" and so on.

This is done for the convenience of anybody who is seeking to subsequently examine an exhibit and they can advise the secretariat as to the day on which the exhibit is filed. If that is satisfactory to everybody and is understood, may I just say one other



word regarding this daily transcript. The daily transcript will be available each evening at eight o'clock and each counsel seeking to obtain copies should make their arrangements with the Court Reporters, Mr. Young being the man in charge, and they could make , at the same time, arrangements as to where the transcript will be available.

May I call Mr. Somerville, the Deputy Minister of Mines and Minerals of the Province.

- - - - -

H. H. SOMERVILLE, called

BY MR. PATILLO:

Q. Mr. Somerville, before you commence to read your brief, may we have on the record what your Christian names are?

A. Hubert Henry Somerville.

Q. And you are the Deputy Minister of Mines and Minerals of the Province of Alberta?

A. Yes.

Q. How long have you occupied that position?

A. Since June 1, 1952.

Q. With that introduction, would you please proceed, Mr. Somerville?

A. Thank you.

Mr. Chairman, members of the Commission,



I would first like to say that some of the exhibits that will be presented with my submission are included in booklet form. There are some that could not conveniently be placed in the booklet and will be indicated as such.

Submission to Royal Commission on Energy by the Department of Mines and Minerals, Government of the Province of Alberta, under Federal Administration.

The mineral resources owned by the Crown in that part of Canada now contained within the Province of Alberta were administered by the Department of the Interior of the Federal Government from 1870 until the transfer of the natural resources to the Province of Alberta in 1930.

The patents for lands granted as homesteads or sold on or before the 31st day of October, 1887, included the mines and minerals. On that day Order in Council No. 1070 was passed authorizing the Minister of the Interior to insert a clause in all patents for lands that were granted after October 31, 1887, reserving to Her Majesty all mines and minerals which may be found to exist within, upon or under the lands, together with full power to work the same and for that purpose to enter upon, and use and occupy the lands or so much thereof, and to such an extent as may be necessary for the effectual working of the minerals, or the mines,



pits, seams and veins containing the same.

LAND SALES

During the year 1898, applications were made to the Department of the Interior to prospect for petroleum in lands in southern Alberta and by Order in Council No. 1822 of the 6th day of August, 1898, the Minister of the Interior was authorized to reserve for an applicant for a period of six months an area not exceeding 640 acres of land to prospect thereon for petroleum and in the event of oil being found in paying quantity to sell the land to the applicant at the rate of \$1.00 per acre with the provision that a royalty of $2\frac{1}{2}$ per cent upon the sales of the petroleum be paid to the Crown. This order applied to lands situated south of the Canadian Pacific Railway in the District of Alberta.

The Order was rescinded by Order in Council No. 893 on the 31st day of May, 1901 which recites that it was deemed no longer advisable in the public interest to reserve for an applicant any particular area of land for the purpose of prospecting thereon for petroleum. The new Order in Council provided that all unappropriated Dominion lands in what is now Alberta on and after the first day of July, 1901, were open to prospecting for petroleum by any individual or company desiring to do so. Should oil in paying



quantity be discovered by a prospector on any vacant land of the Crown, an area not exceeding 640 acres of land including and surrounding the land on which the discovery was made could be sold to the person or company making such discovery at the rate of \$1.00 an acre subject to a royalty at the rate from time to time prescribed by Order in Council.

In December, 1902, the regulations were amended permitting the Minister to reserve for an individual or company who had machinery on the land to be prospected, an area of 640 acres of such shape as the Minister approved and the reservation made for such period as the Minister decided.

By an amendment in May, 1904, the area to be reserved for an individual or company was increased to 1,920 acres, the length of the tract not to exceed three times its breadth. Should oil in paying quantity be discovered by the prospector an area not exceeding 640 acres would be sold at the rate of \$1.00 an acre and the remainder of the area reserved, namely, 1,280 acres would be sold at the rate of \$3.00 an acre. The amendment provided that the patent for the land would convey the surface and the petroleum but would exclude all other minerals. This was the first indication of the rights to be conveyed in the patent.

The regulations were amended in July, 1905,



to apply to lands the surface rights of which had been disposed of subject to the condition that the prospector, before entering upon lands disposed of, had to obtain a lease from the owner of the surface rights upon a form approved by the Minister of the Interior. The next amendment came in December, 1906, permitting the Minister upon application to make reservation of an area of 1,920 acres for a period of four months for the purpose of allowing the applicant a sufficient time to install on the land the required machinery.

(Page 28 follows)



D The fee for a reservation was \$100.00. If the applicant failed to place machinery on the land within the period of four months the fee was forfeited while if the machinery were placed upon the land and oil were found in paying quantity the fee could apply upon the purchase price or be refunded in case no discovery were made. During the period that the reservation was held the rights and privileges were not assignable. The Order also provided that the regulations for the reservation and sale of petroleum lands applied to the reservation and sale of lands for natural gas purposes.

These regulations for sale of petroleum and natural gas lands were rescinded on the 11th day of March, 1910. I do not know of the number or extent of the sales made to that date. However, twelve sales were patented covering 16,028 acres. Two of the patents were for surface and petroleum in 166 acres in Waterton Lakes National Park. Two other patents within the same park covered surface and petroleum and natural gas in 1,375 acres. One patent was granted for surface and petroleum and natural gas in 1,762 acres at Bow Island. The remaining seven patents were for surface and petroleum and natural gas in areas totalling 12,725 acres along the Athabasca River north of McMurray.

The first regulations governing the leasing of petroleum and natural gas rights came into being on May 2, 1910.. These regulations applied



to all Dominion lands in Alberta.

LEASES

The main features of the leases were

Rental - Twenty-five cents an acre for the first year and fifty cents an acre for each succeeding year.

Term - Twenty-one years and renewable for twenty-one years.

Maximum Area - 1,920 acres.

Work Required- Install machinery suitable for carrying on prospecting operations within one year of the date of the lease with the proviso that the value of the machinery so installed need not exceed the sum of \$5,000.00. Within fifteen months of the date of the lease commence boring operations on the leashold.

Rights Conveyed - Oil and natural gas rights, the property of the Crown.

Royalty - None on petroleum products until the first day of January, 1930. After that date subject to the royalty prescribed by regulations. On natural gas a royalty at the rate from time to time specified by Order in Council on the natural gas products recovered.

Credits - The rentals for the second and third year of the lease could be satisfied from



expenditures incurred in drilling.

Number of Leases - Only the maximum area of 1,920 acres could be held under lease by application but there was no restriction as to the number of leases that might be held by assignment.

Minor changes were made in the lease regulations up to 1930. The rental for the first year was increased from 25 cents to 50 cents an acre and the rental for each succeeding year was increased from 50 cents to \$1.00 an acre. The application of drilling credit in satisfaction of rentals was extended to the fourth and fifth year's rentals. The rights conveyed were restricted to the oil and gas that could be obtained by the usual process of boring but not the oil shale rights nor the oil which might be recovered from such shales by the process of extraction customary in such cases. Provision was made in 1913 for a lessee to group his leases so that the drilling of a well would satisfy the drilling of one well on each lease included in the group, the maximum area permitted in a group was 12,800 acres and this was increased in 1922 to 20,000 acres.

SCHOOL LANDS

Regulations for the issue of leases for petroleum and natural gas rights in school lands were established on May 14, 1913. The lease conditions were much the same as for Dominion lands excepting



that the maximum area that could be held by application was 640 acres and there was no provision for grouping for drilling until the regulations applying to Dominion lands were made to apply to school lands on the twelfth day of July, 1928.

PROSPECTING PERMITS

Regulations governing the issue of permits to prospect for petroleum and natural gas, the property of the Crown, were established on May 7, 1928.

The terms of the permits may be summarized

Rental - Ten cents an acre.

Cash Bond - Forty cents an acre, refundable if core drilling or other satisfactory operations conducted.

Term - One year.

Maximum Area - 1,920 acres.

Right to Lease - Entire area.

Credits - The first year's rentals on the lease applied for out of the permit could be satisfied from expenditures incurred in exploration.

ROYALTY

As previously mentioned the petroleum and natural gas leases provided that no royalty would be charged upon the sales of the petroleum obtained until the 1st day of January, 1930.

In 1920 representations were made to the



Department of the Interior that failure to fix the royalty that might be charged on the products of petroleum locations had the effect of retarding development, as persons contemplating investment in the industry hesitated to incur the large initial expenditure necessary to insure success without knowing what royalty would be charged upon the oil that might be discovered. Upon consideration of these representations an Order in Council dated October 29, 1920, provided that for a period of five years after the date upon which the Minister of the Interior might decide that oil in commercial quantity had been discovered, the royalty to be collected would not exceed 5% of the sales of the products nor be less than $2\frac{1}{2}\%$, and for a further period of five years the royalty to be collected would not exceed 10% of the sales nor be less than 5%, and thereafter the royalty would be 10% of the sales of the products.

In July, 1929 Honourable Charles Stewart, Minister of the Department of the Interior published by advertisement a notice to holders of petroleum and natural gas leases comprising Dominion and School Lands, that on and after the 1st day of January, 1930, they were required to pay to the mining recorder for the district a royalty of 5% of the petroleum and naphtha produced from wells situated on lands comprised in their leaseholds. No royalty was prescribed on sales of natural gas.



TRANSFER TO PROVINCE

The transfer of the natural resources to Alberta took effect on October 1, 1930 and the active petroleum and natural gas leases and prospecting permits transferred to the Province for administration consisted of:

<u>Nature</u>	<u>Number</u>	<u>Acreage</u>
Leases on Dominion lands	16,904	2,269,236
Leases on school lands	1,964	191,726
Prospecting permits	99	82,965

The mineral status in the Province at the time of the transfer may be summarized as:

Retained by Canada

	<u>Acreage</u>
In Dominion Parks	13,434,240
In Indian Reserves	1,328,090

Granted by Canada to

Railways	13,031,731
Hudson's Bay Company	2,404,000
Others including home- steads, prospectors, etc...(estimated)	564,269

Acquired by Alberta in the transfer.. 132,620,070

Total Acreage in the Province	163,382,400
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The Hudson's Bay Company was entitled to one twentieth of the lands within that area of the Province lying to the south of the North Saskatchewan River that were surveyed before 1920. The general area in which these grants were made is



outlined in red on a map of the Province. Railway companies were granted approximately sixteen sections in each township in certain areas in the Province. Some years prior to the transfer of the resources to the Province exchanges were made of lands by the railway companies with the Crown to permit consolidation of railway lands in areas where irrigation projects were contemplated. These consolidated areas of railway lands are colored in green. The areas outlined in green on the map show the areas where railway lands were granted but not involved in the consolidation.

MR. PATTERSON: Mr. Chairman, I suggest the submission be marked as Exhibit C-3-2 and the map will become Exhibit C-3-2-A.

---EXHIBIT NO. C-3-2: Submission of the Government of Alberta.

---EXHIBIT NO. C-3-2-A: Map of Province referred to above.

(Page 35 follows)



Take E
JF/p
3/2

MR. SOMERVILLE: This is the map, sirs, the red line indicating the area, generally, in which the Hudson's Bay acquire one-twentieth of the lands. The area outlined in green being the area where the railways companies generally got sixteen sections within each township, and the coloured green area indicates the areas consolidated with the railways companies and the lands that went in to make up this consolidation came out of these particular areas.

We now come to Provincial Administration.
DEPARTMENT OF LANDS AND MINES

The statutes and regulations of the Federal Government pertaining to natural resources in the province were continued in effect by The Administration of Natural Resources (Temporary) Act until June 18, 1931, on which day The Provincial Lands Act came into force by proclamation together with the regulations under the Act.

The Provincial regulations of interest here were:

1. Regulations governing the issue of permits to prospect for petroleum and natural gas.
2. Petroleum and Natural Gas Regulations (Provincial Lands).
3. Petroleum and Natural Gas Regulations (School Lands).



These regulations were practically identical to the regulations in force immediately prior to the transfer of the resources to the Province.

With the advancement of geological and geophysical methods for locating structures suitable for oil accumulation it became apparent that prospecting permits did not cover adequate acreage, so in January of 1936, the regulations were amended permitting the size of areas granted to be in the discretion of the Minister instead of the maximum area of 1,920 acres that prevailed before. At the same time the regulations dealing with leases in Provincial lands were amended increasing the size of groups to 50,000 acres and permitting the application of drilling credits in satisfaction of lease rentals up to and including the twelfth year of the lease.

In September of 1937, the prospecting permit regulations were rescinded and replaced by Regulations Governing Petroleum and Natural Gas Reservations allowing up to 50,000 acres to be included in a reservation.

In March of 1941, new regulations were established for the reservation of petroleum and natural gas rights. The maximum area of a reservation was increased to 200,000 acres and a person was permitted to hold in his own name at any one time



three reservations.

New regulations were established in August of 1941 governing the disposal of petroleum and natural gas rights, the property of the Crown in Provincial lands and in school lands. The areas obtainable under lease by application were increased from 1,920 to 9,600 acres. The number of acres to be included in a group for drilling was reduced to 19,200 acres but provision was made to permit the application of excess credits to satisfy the rental on not more than 35,000 acres in any year of other leases held by the lessee and situated elsewhere in the Province.

In July of 1947, some five months following the Leduc discovery the number of reservations a person could hold at any one time was reduced to two, each covering not more than 100,000 acres. The right to assign a reservation was then withdrawn. In August of the same year new lease regulations were established increasing the maximum of a lease to sixteen sections or 10,240 acres and requiring the creation of a Crown reserve of equal acreage in close proximity to the lease. This meant that anyone applying for leases in an area held under reservation could acquire not in excess of 50% of the lands contained in the reservation.

In March, 1948, the lease regulations were again changed to reduce the maximum size of



the lease to nine sections or 5,760 acres. The length of a lease could not exceed four miles and could not exceed twice its breadth, meaning that if a lease were taken in the form of a square each of its boundaries could be three miles in length while if it were taken in the form of a rectangle, the maximum would be eight sections of 5,120 acres. The restriction on the maximum acreage acquired by application was removed and following that time there has been no restriction on the number of leases that may be held by application or assignment.

Royalty

The royalty of 5% of sales of oil set by the Minister of the Interior continued until January 1, 1935. The royalty for the period of five years commencing January 1, 1935, was 10% of the sales and the royalty from January 1, 1940 to June 1, 1941 was $12\frac{1}{2}\%$.

New royalty regulations came into effect on June 1, 1941, requiring that the royalty to be computed, levied and collected on all products, other than natural gas, obtained from a well would be that percentage of the products obtained equivalent to the square root of the average daily production, subject to the proviso that with the first return for the well an election could be made to pay royalty until the end of May, 1951, at



12 $\frac{1}{2}$ % of all products, other than natural gas, instead of on the square root formula.

The royalty on all products, other than natural gas, obtained from a lease acquired prior to the transfer of the natural resources to the Province was continued at 10%.

The royalty on natural gas for the ten year prior commencing June 1, 1941, was 15% of the selling price subject to a minimum royalty of one-quarter of one cent per thousand cubic feet. The minimum royalty on natural gas was increased on March 30, 1958, to three-quarters of one cent per thousand cubic feet.

DEPARTMENT OF MINES AND MINERALS

The Department of Lands and Mines ceased to exist on April 1, 1949, on which date the Department of Mines and Minerals came into being. The Mines and Minerals Act (Exhibit C-3-2-B) came into force on that day and applies to all mines and minerals vested in or belonging to the Crown in right of the Province, and also applies to all mines except:

- (a) as to the working and operating of a coal mine or to any working incidental to the extraction of coal, or
- (b) to any drilling, production or abandonment operations of a well for



which a licence is required by the provisions of The Oil and Gas Conservation Act.

MR. PATTILLO: Mr. Chairman, perhaps this might be a good point at which to have the morning break before we start in with the next section.

THE CHAIRMAN: Certainly. I was going to suggest it at the end of the next paragraph, but it is perfectly all right to have it now. We will adjourn for a break of ten minutes.

---A short recess.

(Page 41 follows)



MR. PATTILLO: Mr. Chairman, before Mr. Somerville resumes may I refer to something I said in my opening regarding the procedure to be followed which I did not sufficiently amplify. I referred to the fact that we were proposing to take the evidence of the witnesses of Trans-Canada under oath. I should have said that that was being done at the express request of the company, and that they came and made that request to us before we gave consideration to whether or not that should be done. I think I should also make it clear that where we are dealing with companies in a comparable position to that of Trans-Canada we will be doing as we propose to do with Trans-Canada, and asking them to agree to have their witnesses examined under oath.

THE CHAIRMAN: Thank you very much, Mr. Pattillo. Will you proceed, Mr. Somerville?

MR. SOMERVILLE: Thank you, sir.

The Mines and Minerals Act is divided into parts and it is proposed in this submission to comment on each part that deals with petroleum and natural gas disposals. In Part I of the Act Section 19 empowers the Lieutenant Governor in Council to establish a tariff of fees and Regulation No. 798/57 embodies the existing tariff of fees. That is filed as an exhibit.

MR. PATTERSON: That will become Exhibit C-3-2-C, Mr. Chairman.



---EXHIBIT NO. C-3-2-C: Copy of Regulation
No. 798/57

MR. SOMERVILLE: Royalty.

Royalty payable after June 1, 1951, is in accordance with the Petroleum and Natural Gas Royalty Regulations. That is filed as an exhibit.

MR. PATTERSON: That will become Exhibit C-3-2-D, Mr. Chairman.

---EXHIBIT NO. C-3-2-D: Copy of The Petroleum and Natural Gas Royalty Regulations.

MR. SOMERVILLE: That came in force on June 1st, 1951.

In summary the royalty on crude oil is 16 $\frac{2}{3}$ per cent for wells producing over 4,050 barrels a month, decreasing to 12 $\frac{1}{2}$ per cent when the monthly production is 1,500 to 1,800 barrels and decreasing to 5 per cent at 600 barrels per month.

The royalty on natural gas or residue gas sold or consumed for some useful purpose is 15 per cent of the selling price or fair value at the time and place of production, subject to a minimum of three-quarters of one per cent per thousand cubic feet unless the gas is processed to obtain liquid hydrocarbons, sulphur compounds or carbon dioxide. The royalty with respect to other fluid hydrocarbons and sulphur obtained by processing natural gas is



12 1/2 per cent of the selling price. These royalty regulations will continue in force until June 1, 1961, and thereafter until changed by Order of the Lieutenant Governor in Council.

A statement of royalties collected by calendar years following 1947 has been prepared, and this is filed as an exhibit.

MR. PATTERSON: Exhibit C-3-2-E, Mr. Chairman.

---EXHIBIT NO. C-3-2-E: Statement of royalties collected by calendar years following 1947.

MR. SOMERVILLE: Part VI of the Act:

This part provides for:

- (a) the establishment and disposal of Crown reserves,
- (b) the provisions applicable to petroleum and natural gas leases, and
- (c) empowers the Lieutenant Governor in Council to make regulations governing disposal of petroleum and natural gas rights and natural gas rights.

Crown Reserves: The petroleum and natural gas rights, the property of the Crown, in areas described in Section 277 of The Mines and Minerals Act are constituted Crown reserves.

These areas are:

1. fractional areas of less than one-quarter



section,

2. the areas within 14 provincial reserves indicated on the map -- and this is filed as an exhibit.

MR. PATTERSON: Exhibit C-3-2-F, Mr. Chairman.

---EXHIBIT NO. C-3-2-F: Map showing 14 provincial reserves.

Now, on this exhibit the provincial reserves are shown, and in total they cover approximately 12,878 square miles.

3. an area equal in size and in close proximity to a petroleum and natural gas lease, and
4. the lands in a petroleum and natural gas reservation that the holder of the reservation is not permitted to acquire under lease. These areas comprise 50 per cent of the lands in the reservation.

A Crown reserve may be disposed of upon such terms and conditions as may be prescribed by the Lieutenant Governor in Council and disposition is made by advertising in the following instances:

1. leases in proven or semi-proven areas,
2. Leases in unproven areas,
3. reservations in provincial reserves,
4. Crown reserve drilling reservations, and
5. Crown reserve natural gas licences.

At this point I would mention that we have



here twelve copies of each type of advertisement pertaining to disposal of Crown reserves, and if it is your wish, Mr. Chairman, they can be filed as exhibits.

THE CHAIRMAN: Thank you, sir, yes.

MR. PATTERSON: Might those go in as one exhibit, Mr. Chairman; Exhibit C-3-2-G?

THE CHAIRMAN: Yes.

EXHIBIT NO. C-3-2-G:

Copies of types of advertisements pertaining to disposal of Crown reserves.

MR. SOMERVILLE: When a right to a disposition in a Crown reserve is offered for sale, the highest offer is always accepted unless, in the case of a lease in 1 or 2 above, it is considered that the highest offer is not commensurate with the estimated value of the lease and all offers for the lease are rejected.

If a fractional area is required to complete a spacing unit for a well the Lieutenant Governor in Council may set the purchase price at which the operator of the well may acquire a petroleum and natural gas lease or a natural gas lease of the fractional area. The purchase price may be set in the same way for a natural gas lease required for the operation of a natural gas utility.

Disposals of leases in Crown reserves commenced in the year 1948 and disposals of reservations and licences followed. Revenues to the



Province from Crown reserve disposals by years are indicated in the statement, which is filed as an exhibit.

MR. PATTERSON: Exhibit C-3-2-H, Mr. Chairman.

THE CHAIRMAN: Thank you.

---EXHIBIT NO. C-3-2-H: Statement indicating revenues to the Province from Crown reserve disposals by years.

Dispositions: Mention is made that each petroleum and natural gas lease issued following May 15, 1948 and each natural gas lease includes a covenant by the lessee that natural gas taken from the lease shall be used within the Province of Alberta unless the consent of the Lieutenant Governor in Council to its use elsewhere is obtained. Consent is given after a permit is obtained authorizing the removal of the gas from the Province under The Gas Resources Preservation Act.

The various types of disposals with the year of their first coming into being are -- and these are under "Type" and "Year".

<u>Type</u>	<u>Year</u>
Petroleum and natural gas lease	1910
Petroleum and natural gas reservation	1937
Crown reserve drilling reservation	1954
Natural gas licence	1951
Crown Reserve natural gas licence	1952
Natural gas lease	1952



At December 31, 1957, the number and acreage of leases, reservations and licences were -- and these are under the headings "Nature of disposition", "Number" and "Acreage".

<u>Nature of Disposition</u>	<u>Number</u>	<u>Acreage</u>
Petroleum and natural gas leases	27,167	22,213,525
Petroleum and natural gas reservations	889	50,396,500
Crown reserve drilling reservations	157	1,152,506
Natural gas licences	11	215,931
Crown reserve natural gas licences	17	328,289
Natural gas leases	302	1,540,398
Totals	28,543	75,847,149

In total the number of dispositions is 28,543 and they are covering an area of 75,847,149 acres.

When a petroleum and natural gas lease is cancelled or surrendered the rights contained therein and the rights in the Crown reserve established for the lease, do not again become available for application as a lease or reservation until the rights have been posted for tender for a period of thirty days. If a tender is not received the rights are available for application to the first person applying at the appropriate office of the Department after 8.30 a.m. on the following day. The same procedure applies when a reservation is cancelled or surrendered or when a portion of a



terminated reservation is not required for leases and their appurtenant Crown reserves.

At this point, Mr. Chairman, we have copies of the said notices, one copy of the type in use by the Mining Recorder for disposition by lease, and the other is the one in use by the Director of Mineral Rights in the disposal of assets by reservation. These may be filed as exhibits.

THE CHAIRMAN: Thank you.

MR. PATTERSON: C-3-2-I, Notices of Sale.

---EXHIBIT NO. C-3-2-I-1: Notice used by The Mining Recorder.

---EXHIBIT NO. C-3-2-I-2: Notice used by the Director of Mineral Rights.

(Page 49 follows)



G Bonuses received for rights offered under the preceding paragraph and revenues to the Province by years from 1947 from rentals on petroleum and natural gas disposals and natural gas disposals appear in the exhibit filed.

MR. PATTERSON: The table of revenues will become Exhibit C-3-2-J.

---EXHIBIT NO. C-3-2-J: Table of Revenues.

THE WITNESS (Continuing): Over the years the reservations granted for exploring for petroleum and natural gas have been located within the general area outlined in red on the map of the Province displayed as an exhibit.

MR. PATTERSON: That will be Exhibit C-3-2-K, the map.

---EXHIBIT NO. C-3-2-K: Map indicating reservations granted for exploration.

THE WITNESS: In explaining the various types of disposals of petroleum and natural gas rights and natural gas rights, the main features are summarized.

THE CHAIRMAN: Mr. Somerville, I would think, with respect to the main features of these leases, we could take the information as read into the record and it would not be necessary for you to read all that detail; but I would like to get it into the record as part of your brief.



THE WITNESS: Thank you, sir. I might mention that each summary refers to an exhibit, the next exhibit being the form of petroleum and natural gas leases, which occurs on page 19.

MR. PATTERSON: Might we, then ---

THE CHAIRMAN: I think we had better take a minute to make sure about getting your numbering of the exhibits correct.

MR. PATTERSON: Thank you, sir. The form of petroleum and natural gas leases will become Exhibit C-3-2-L. That is the document summarized commencing at page 19, and Exhibit C-3-2-M is the document summarized commencing at page 21. Exhibit C-3-2-N is the document summarized commencing at page 24 and Exhibit C-3-2-O the document summarized commencing at page 26. Exhibit C-3-2-P is the document summarized commencing at page 29 and Exhibit C-3-2-Q is the document summarized commencing at page 31, and in all cases the page numbers refer to the brief which was filed as Exhibit C-3-2.

THE WITNESS: (Read into record)

Petroleum and Natural Gas Leases

Fee - \$10,00

Annual rental - \$1.00 an acre.

Maximum area - 5,760 acres in the form of a square
or 5,120 acres in a rectangular form.

Number - The lease is in the form prescribed
by the Minister.



- Term - 21 years
- Renewable - For terms of 21 years each so long as the leasehold is capable of producing petroleum or natural gas in commercial quantity.
- Rights granted - The lease grants the right to the petroleum and natural gas but does not include the right to bituminous sands nor to the petroleum or natural gas that may be recovered from bituminous sands.
- Royalty - As prescribed by the Petroleum and Natural Gas Royalty Regulations.
- Maximum royalty - The maximum royalty on petroleum during the first term of 21 years is one-sixth.
- Work required - The drilling of a well is to be commenced within one year of issue of the lease. When a well is abandoned, the drilling of the next well is to be commenced within six months and when a well is completed as a producer, the drilling of the next well is to be commenced within ninety days. These requirements are not now enforced and before any are enforced the lessee will be given at least 30 days notice to commence drilling.
- Grouping - A lessee may group his leases, any



portion of which are located within a radius of three miles of the projected well site, but not more than 11,520 acres may be included in a group. The drilling of a well or wells on grouped leases meets the requirements for drilling in the same manner as drilling on a lease. When petroleum is discovered in a leasehold the lease may not continue in a group.

Offset
drilling

- If production of petroleum is taken from a well on freehold property and the spacing unit for the well laterally adjoins a lease, the lessee must commence drilling of an offset well within ninety days of the well coming into production on the freehold land. Where a well produces natural gas from freehold property, upon considering market requirements and after consultation with the lessee an offset well may be required to offset the freehold gas producer. If a lessee does not wish to drill an offset well he may surrender out of the lease the area of the spacing unit or he may obtain a deferment from year to year upon payment of a penalty or additional rental as may



be prescribed each year by the Minister.

Surrender - A lessee may surrender his lease at any time and may surrender a portion of the lease with the consent of the Minister.

Crown Reserves - When a lease is applied for, an area of equal acreage becomes a Crown reserve in the same township in as close proximity to the lease as possible.

Transfer - A lessee may transfer his lease or certain portions thereof if the transfer is registered under Part VIII of The Mines and Minerals Act.

---EXHIBIT NO. C-3-2-L: Form of Petroleum and Natural Gas Leases.

THE WITNESS (Read into record):

Petroleum and Natural Gas Reservations

Fee - \$250.00

Deposit - \$2,500.00 for each 20,000 acres or portion thereof payable in cash or negotiable bearer bonds of the Dominion of Canada or of the Province of Alberta to guarantee compliance with the regulations.

Maximum area - 100,000 acres.



- Length of tract - Not to exceed three times its breadth.
- Number - No person may hold more than two reservations by application at any one time. No restriction on number that may be obtained by transfer.
- Form of reservation- The reservation is in the form prescribed by the Minister.
- Term - Four months.
- Renewals - Four months free,
Four months free,
Three months at seven cents an acre,
Three months at seven cents an acre,
Three months at eight cents an acre,
Three months at eight cents an acre.
- Renewals if drilling program underway - Three months at ten cents an acre,
Three months at fifteen cents an acre,
Three months at twenty cents an acre,
Three months at twenty-five cents an acre,
Three months at twenty-five cents an acre,
Three months at twenty-five cents an acre.
- Extensions - Where the nature of the terrain or inaccessibility of the area or any other conditions over which the holder of the reservation has no control, retards the carrying out of the examination, each of



the renewals granted at seven and eight cents may be extended free for not more than three months, meaning that a reservation may be held for a maximum of three years without drilling.

Further extensions- At the close of the last eight cent renewal if the Department is satisfied that the nature and inaccessibility of the area has seriously retarded the performance of the examination, the reservation may be extended for a further period or periods upon such terms and conditions including the payment of a fee or fees as the Minister may prescribe.

Work required - During the first ninety days of the reservation the holder must submit to the Department a proposed plan of examination and if the plan is approved the holder must within the next month submit evidence of the engagement of qualified personnel together with the date when the examination will commence. Thereafter work is expected to be done during any period unless restricted by weather or ground conditions.

Reports required - A progress report must accompany each



application for renewal and at the termination of the reservation a final report is required including a map or maps showing the factual data obtained in the examination together with copies of any logs or electrologs taken.

Credit - A credit not exceeding fifty per cent of the expenditures incurred in the examination may be granted to apply to the rental for the first year or any lease or leases applied for out of the reservation area.

Surrender - The holder may surrender all or any part of his reservation at any time.

Transfer - The holder of a reservation may transfer his reservation if the transfer is registered under Part VIII of The Mines and Minerals Act.

Leases and
Crown Re-
serves

- Prior to termination of the reservation the holder may apply to lease not more than fifty per cent. of the area in each township comprised in the reservation. The leases or concentration of leases must be in blocks not exceeding three miles square or four miles by two miles. The blocks may corner or be separate one from the other by at least one



mile and the remainder of the lands in the reservation are reserved by the Crown and become 'Crown Reserves'.

If in drilling a well on a reservation a discovery of oil is made, application for lease surrounding the well must be made within three months of the discovery and the drilling of another well is not permitted within four and one-half miles of the discovery until application is made for the lease. The balance of the Crown Reserves for the lease block may continue under reservation.

---EXHIBIT NO. C-3-2-M: Petroleum and Natural Gas Reservations.

THE WITNESS: (Read into record)

Crown Reserve Drilling Reservations

Fee - \$250.00

Rental - 25 cents an acre.

Maximum area - As prescribed in each case.

Manner of application- Anyone may ask to have the petroleum and natural gas rights in Crown reserve areas advertised for sale as a drilling reservation.

Granting of reservation- If the rights are advertised, the reservation is granted to the highest



tenderer.

Number - A person may hold any number of
reservations.

Form of
reservation- The reservation is in the form pres-
cribed by the Minister.

Term - Six months.

Renewals - Six months at 25 cents an acre,
Six months at 25 cents an acre,
Six months at 25 cents an acre,
Six months at 25 cents an acre,
Six months at 25 cents an acre.

Work re-
quired - Within one year of the date of the
reservation, the holder must commence
the drilling of a well with a view to
finding oil, and within three months of
the completion or abandonment of a well,
the drilling of another well must be
commenced.

Suspension
of drilling- Where drilling is delayed because of
weather or other conditions and through
no fault of the holder of the reserva-
tion, consent may be given to the sus-
pension of drilling for a period not in
excess of six months upon such terms and
subject to such conditions as may be
prescribed by the Minister.



- Credit - A credit may be granted for expenditures incurred to satisfy the rental for the first year of any lease or leases applied for out of the reservation.
- Surrender - The holder may surrender all or any part of his reservation at any time.
- Transfer - The holder of a reservation may transfer his reservation if the transfer is registered under Part VIII of The Mines and Minerals Act.
- Leases - Prior to termination of the reservation, the holder may apply to lease the petroleum and natural gas rights in the number of quarter sections permitted by the notice of sale, provided a well has been drilled to test for oil in the zone specified or a well has been completed as an oil producer from any other zone.
- Discovery of oil - When oil is discovered in the drilling of a well, the holder of the reservation must within three months apply to lease the petroleum and natural gas rights in the number of quarter sections permitted by the notice of sale and the drilling of another well may not be commenced in this period unless the holder



of the reservation proposes to drill to test for oil in another zone and the subsequent drilling program is approved by the Minister.

Crown re-serves - The areas not granted under lease continue as Crown reserves.

---EXHIBIT NO. C-3-2-N: Form of Crown Reserve Drilling Reservations.

THE WITNESS: (Read into record)

Natural Gas Licences

Fee - \$250.00

Rental - Five cents an acre.

Maximum area - 100,000 acres.

Manner of application- If the holder of a reservation of petroleum and natural gas rights in drilling a well or wells fails to find oil but determines the presence of natural gas he may apply for a licence of the natural gas in all or any portion of the lands comprised in the reservation.

Granting of licence- The applicant must furnish a report regarding the natural gas found in the zone or zones applied for so that the zone or zones may be adequately designated in the licence in relation to a



general area or in respect to a specified well or wells.

Number - A person may hold any number of licences.

Form of licence - The licence is in the form prescribed by the Minister.

Term - Six months.

Renewals - Six months at five cents an acre,
Six months at five cents an acre,
Six months at five cents an acre,
Six months at five cents an acre,
Six months at five cents an acre.

Natural gas - For the purpose of these licences 'natural gas' means the production from any well that in the opinion of the Oil and Gas Conservation Board initially produces gas either alone or with oil at a gas-oil ratio of 10,000 cubic feet to the barrel or higher.

Work required - Within three months of the date of the licence the licensee must commence the drilling of a well to test for natural gas in the zone or zones specified in the licence and within three months of the completion or abandonment of a well the drilling of another well must be



commenced.

Suspension
of drilling- Where drilling is delayed because
of weather or other conditions and
through no fault of the licensee, con-
sent may be given to the suspension of
drilling for a period not in excess of
six months upon such terms and subject
to such conditions as may be pre-
scribed by the Minister.

Credit - A credit may be granted for expen-
ditures incurred to satisfy the rental
for the first year of any lease or
leases applied for out of the licenced
area.

Surrender - The licensee may surrender all or
any part of his licence at any time.

Transfer - A licensee may transfer his licence
if the transfer is registered under
Part VIII of The Mines and Minerals Act.

Leases - Prior to termination of a licence
the licensee may apply to lease the
rights in the natural gas indicated by
drilling in the zone or zones. The area
that may be acquired under lease is de-
pendent upon the wells drilled and com-
pleted as commercial natural gas wells
on the following basis:



- (a) six sections for each well finding natural gas at a depth not exceeding 3,000 feet;
- (b) eight sections for each well finding natural gas at a depth exceeding 3,000 feet but not exceeding 6,000 feet;
- (c) ten sections for each well finding natural gas at a depth exceeding 6,000 feet.

If in the drilling of adequately spaced wells a field of natural gas is delimited the licensee may, notwithstanding the previous paragraph, lease the natural gas in the field so delimited within the zone or zones contained in the licence.

Discovery of
oil

- If oil is discovered in any licenced zone in the drilling of a well the licensee may obtain a petroleum and natural gas lease of the quarter section containing the discovery providing he surrenders out of the licence three times the area taken under petroleum and natural gas lease.

Crown

Reserves - Not required.

---EXHIBIT NO. C-3-2-0:

Form of Natural Gas
Licences.



THE WITNESS: (Read into record)

Crown Reserve Natural Gas Licences

Fee - \$250.00

Rental - Five cents an acre.

Maximum
area - As prescribed in each case.

Manner of
application- Anyone may ask to have the natural
gas rights in Crown reserve areas adver-
tised for sale as a licence.

Granting
of licence - If the rights are advertised the
licence is granted to the highest ten-
derer.

Number - A person may hold any number of
licences.

Form of
licence - The licence is in the form pres-
cribed by the Minister.

Term - Six months.

Renewals - Six months at five cents an acre,
Six months at five cents an acre,
Six months at five cents an acre,
Six months at five cents an acre,
Six months at five cents an acre.

Natural
Gas - For the purpose of these licences
'natural gas' means the production
from any well that in the opinion of
the Oil and Gas Conservation Board



initially produces gas either alone or with oil at a gas-oil ratio of 10,000 cubic feet to the barrel or higher.

Work re-
quired

- Within three months of the date of the licence the licensee must commence the drilling of a well to test for natural gas in the zone or zones specified in the licence and within three months of the completion or abandonment of a well the drilling of another well must be commenced.

Suspension

of drilling- Where drilling is delayed because of weather or other conditions and through no fault of the licensee, consent may be given to the suspension of drilling for a period not in excess of six months upon such terms and subject to such conditions as may be prescribed by the Minister.

Credit

- A credit may be granted for expenditures incurred to satisfy the rental for the first year of any lease or leases applied for out of the licenced area.

Surrender

- The licensee may surrender all or any part of his licence at any time.

Transfer

- A licensee may transfer his licence if the transfer is registered under Part VIII of The Mines and Minerals Act.



Leases - Prior to termination of a licence the licensee may apply to lease the rights in the natural gas indicated by drilling in any zone or zones found to be commercial. The area that may be acquired under lease is dependent upon the wells drilled and completed as commercial natural gas wells on the following basis:

- (a) six sections for each well finding natural gas at a depth not exceeding 3,000 feet;
- (b) eight sections for each well finding natural gas at a depth exceeding 3,000 feet but not exceeding 6,000 feet;
- (c) ten sections for each well finding natural gas at a depth exceeding 6,000 feet.

Discovery of oil - If oil is discovered in the drilling of a well the licensee may obtain a petroleum and natural gas lease of the quarter section containing the discovery providing he surrenders out of the licence three times the area taken under petroleum and natural gas lease.

Crown Reserves - The areas not granted under lease continue as Crown reserves.



---EXHIBIT NO. C-3-2-P: Form of Crown Reserve
Natural Gas Licences.

THE WITNESS: (Read into record)

Natural Gas Leases

Fee - \$10.00

Annual
Rental - 33 1/3 cents an acre if a market is
available. Otherwise 10 cents an acre.

Maximum
area - No limitation.

Number - A person may hold any number of leases.

Form of
lease - The lease is in the form prescribed by
the Minister.

Term - 21 years.

Renewable - For terms of 21 years each so long as
the leasehold is capable of producing
natural gas.

Rights
granted - The lease conveys the right to drill
for and produce natural gas from the
zone or zones described in the lease.
Natural gas means the production from
any well that in the opinion of the Oil
and Gas Conservation Board initially pro-
duces gas either alone or with oil at a
gas-oil ratio of 10,000 cubic feet to the
barrel or higher.

Royalty - As prescribed by the Petroleum and
Natural Gas Royalty Regulations.



Work re-
quired - The drilling of a well for the purpose of obtaining natural gas must be commenced within six months of the lessee being notified by the Minister to do so. When a well is completed or abandoned the next well must be commenced within six months but not more than one well will be required for each spacing unit. The availability of a market for natural gas may have a bearing on the number of wells required.

Surrender - A lessee may surrender his lease at any time and may surrender a portion of the lease with the consent of the Minister.

Crown
Reserves - Not required.

Transfer - A lessee may transfer his lease or certain portions thereof if the transfer is registered under Part VIII of The Mines and Minerals Act.

---EXHIBIT NO. C-3-2-Q: Form of Crown Reserve Natural Gas Leases.

THE CHAIRMAN: That would bring us, Mr. Somerville, I think, to page 32, is that right?

THE WITNESS: That is, sir.

This Part applies to geophysical and geological explorations. The Regulations Governing



Geophysical Exploration and Exploratory Operations
for Minerals filed as an exhibit.

MR. PATTERSON: Those will become Exhibit C-3-2-R, Mr. Chairman.

---EXHIBIT NO. C-3-2-R: Regulations Governing Geophysical Exploration and Exploratory Operations for Minerals.

THE WITNESS: The regulations also permit operations with the prior consent of the owner or occupant, as the case may be, on lands held under title or under lease from the Crown.

There is a fee for a licence to conduct an operation and a cash deposit to guarantee compliance with the regulations. The licence terminates on the 31st day of March following the date of issue. The fee is \$25.00 and the deposit is \$1,000.00. Anyone operating geophysical equipment must obtain a yearly permit, the fee being \$25.00. Monthly reports are required showing the holes drilled, stations observed, etc.

There are certain areas restricted from operation and these are:

- (a) areas covered by natural or artificial lakes,
- (b) Provincial Parks, Forest Reserves and grounds upon which public institutions are located, and to explore which the administrative body has not granted the

operator permission,

(c) areas in which underground mines are located, and

(d) areas defined as restricted areas by the Minister of Mines and Minerals

If in drilling operations underground water is released and flows to the surface, the hole must be plugged immediately to prevent the escape of water unless arrangements are made with the owner of the surface to complete the hole as a properly controlled water well.

PART VIII

This Part allows the registration of transfers of agreements such as leases, licences and reservations which are not prohibited from being transferred under the Act or the regulations. A transfer may be registered with respect to the whole of an agreement, a specified interest in an agreement or as to a portion of a location described in an agreement. The Minister, apart from the insufficiency of the instrument itself, may refuse to register a transfer where registration would result in more than five persons becoming the holders of the agreement or where the specified undivided interest is less than a ten per cent interest.

On the registration of a transfer the transferee becomes the holder of the agreement. A registered transfer is granted priority under the



Act over an unregistered transfer.

This Part gives the power to the Lieutenant Governor in Council to make regulations providing for the registration of documents other than transfers, a document being defined as an instrument pertaining to any right granted under an agreement. This would allow registration of such documents as farm-out agreements, trust deeds and sub-leases. Owing to certain administrative difficulties, regulations for the registration of documents have not as yet been made.

In 1956 when section 82 of the Bank Act was amended to permit banks to loan moneys on the security of interests in petroleum and natural gas leases and licences, this Part was amended to allow the registration of assignments of interests in leases or licences given as security for loans to chartered banks. In practice, the actual instrument of assignment is registered although provision is made for registration by way of caveat. Since the inclusion of this amendment there have been registered with the Department some three hundred assignments given under section 82 of The Bank Act.

PART IX

Under this Part the Lieutenant Governor in Council may authorize the Minister to enter into an agreement for a unit operation, the term "unit



operation" being defined as an operation in which several tracts containing oil or gas are integrated into a single unit. Agreements for unit operations are entered into between the owners of the oil or gas and the persons who have been granted the right to drill for and produce the oil or gas; the reasons for doing so being to co-ordinate the development and production of an oil or gas field or to implement a program of conservation.

The terms of leases comprising the tracts being integrated in a unit operation are varied to the extent necessary to implement the terms of the unit agreement. In the case of the Crown a subsidiary agreement may be entered into with respect to the determination of the rate of royalty payable on Crown minerals. In addition, unit agreements may contain terms with respect to the storage of gas for use in peak periods or with respect to secondary recovery. The Crown is a party to eleven unit agreements but in view of the fact that secondary recovery is becoming increasingly important in oil fields in Alberta, the number of unit agreements involving Crown leases may be expected to increase.

PART X

This Part applies to bituminous sands defined in The Mines and Minerals Act as

"the oil sands and all other mineral sub-

"stances in association therewith being
"within townships eighty-four to one
"hundred and four inclusive in ranges
"four to eighteen inclusive, west of the
"fourth meridian and occurring in the
"McMurray formation, being the strati-
"graphic formation lying above the
"upper Devonian carbonate sediments and
"below the Clearwater formation."

The Federal Government established regulations for the disposal of bituminous sand deposits, the property of the Crown, in the Province of Alberta five months prior to the transfer of the resources to the Province but no permits were granted thereunder.

Similar regulations were established by the Province in 1931, but no disposal had been made thereunder at the expiry of the regulations on April 1, 1949. In 1952 a form of permit was approved by the Lieutenant Governor in Council for the granting of bituminous sands areas for exploration and fourteen of these permits were granted. They have all terminated and in some cases were followed by lease.

The next regulations for the disposal of bituminous sands rights came into effect on the 14th day of December, 1955 and the areas under permit are shown on the map.



MR. PATTERSON: The map regarding areas of bituminous sand leases will be Exhibit C-3-2-S, Mr. Chairman.

---EXHIBIT NO. C-3-2-S: Map indicating areas of bituminous sand leases.

THE WITNESS: The permit areas are shown in green there, and the map also shows areas presently held under leases and they are shown in yellow, together with areas obtainable under the petroleum and natural gas sale by the Federal Government, and those are the seven little red areas.

The number and acreage of permits and leases now active are:

	<u>Number</u>	<u>Acreage</u>
Bituminous sands prospecting permits	60	2,864,342
Bituminous sands leases	12	100,054.20

The royalty shall be at such rate as may be prescribed from time to time by the Lieutenant Governor in Council on each of the products derived from the bituminous sands but to date the rate has not been established. The provisions pertaining to prospecting permits and leases of bituminous sands rights are summarized.

THE CHAIRMAN: We will take those, Mr. Somerville, into the record as if you had read them.



THE WITNESS: Thank you, sir.

THE CHAIRMAN: I do not know if that is agreeable to you.

THE WITNESS: Thank you.

MR. PATTERSON: Are you filing those?

THE WITNESS: There will be two exhibits: the first is the form of bituminous sands prospecting permits.

MR. PATTERSON: That which is referred to as page 37 will become Exhibit C-3-2-T, Mr. Chairman.

---EXHIBIT NO. C-3-2-T: Form of bituminous sands prospecting permits.

THE WITNESS: (Read into record)

Bituminous Sands Prospecting Permits

Fee	-	\$250.00
Rental	-	5 cents an acre
Deposit	-	\$50,000.00
Maximum area	-	50,000 acres
Number	-	No person may hold more than two permits by application at any one time. No restriction on number that may be obtained by transfer.
Form of permit	-	The permit is in the form prescribed by the Minister.
Term	-	One year.



- Renewals - One year at 10 cents an acre,
One year at 10 cents an acre.
- Work re-
quired - Before the granting of the permit the
permittee must furnish a satisfactory
plan of the proposed examination. Work
conducted must be in accordance with
the plan of examination.
- Reports
required - With each application for renewal
the permittee must report on the pro-
gress made and the portion of the ex-
amination expected to be completed with-
in the renewal period. At the termina-
tion of the permit a final report is
required with a complete copy of every
log taken of each hole drilled.
- Surrender - The permittee may surrender all or any
part of his permit at any time.
- Transfer - The permittee may transfer his permit
if the transfer is registered under Part
VIII of The Mines and Minerals Act.
- Leases - Prior to termination of the permit
the permittee may apply for a lease of
bituminous sands rights in an area with-
in the lands described in his permit
provided operations have been conducted
in accordance with the Department's re-
quirements.



Crown
Reserves - Not required.

The next one is on page 38.

MR. PATTERSON: That is described as
the bituminous sands leases, and the form will be-
come Exhibit C-3-2-U.

---EXHIBIT NO. C-3-2-U: Form of Bituminous Sands
Leases.

THE WITNESS: (Read into record)

Bituminous Sands Leases

Fee - \$5.00

Annual
rental - 25 cents an acre for the first five
years of the term, \$1.00 an acre for the
balance of the term.

Deposit - \$5.00 an acre subject to a maximum of
\$50,000.00 and a minimum of \$10,000.00.
Upon completion of the plant or other
works satisfactory to the Minister the
deposit is refundable.

Maximum
area - 50,000 acres

Number - A person may hold any number of leases.

Form of
lease - The lease is in the form prescribed by
the Minister.

Term - 21 years

Renewable - For terms of 21 years each so long as
a plant or other works are in operation.



- Royalty - As prescribed by the Lieutenant Governor in Council.
- Maximum royalty - The maximum royalty on products recovered during the first term of 21 years is one-sixth.
- Work required - The building of a plant or other works shall be commenced within one year from the date upon which the lessee is given notice by the Minister to do so and the plant or other works must be placed in operation within four years from the date of the notice given by the Minister. The notice by the Minister shall not be given until the expiration of at least one year from the date of the lease.
- Surrender - A lessee may surrender his lease at any time and may surrender a portion of the least with the consent of the Minister.
- Transfer - A lessee may transfer his lease or certain portions thereof if the transfer is registered under Part VIII of The Mines and Minerals Act.
- Crown Reserves - Not required.

(Page 79 follows)



This concludes the portion of the sub-
mission relating to The Mines and Minerals Act.

I now propose to comment on other factors
affecting the oil and gas industry that are governed
by statutes administered by the Department of Mines and
Minerals.

ACQUISITION OF SURFACE

The Right of Entry Arbitration Act is
filed as an exhibit.

MR. PATTERSON: The Right of Entry Arbi-
tration Act, Mr. Chairman, will be Exhibit C-3-2-B.

---EXHIBIT NO. C-3-2-B: The Right of Entry
Arbitration Act.

MR. SOMERVILLE: The Right of Entry
Arbitration Act deals with the acquisition of the
surface of land required by operators in the
development of their minerals where agreement cannot
be reached with the surface owner. In effect it
takes away the common law right of a mineral owner
to work his mineral but at the same time provides
a procedure to enable him to acquire what surface
area he requires without litigation. It also
ensures that surface owners are fairly compensated
for loss of the surface, damage to the land and
inconvenience arising from the mineral owner's
operations.

Under the Act, a Board of Arbitration is
constituted consisting of three members. A secretary



to the Board and a staff are provided. The Board members are appointed by the Lieutenant Governor in Council but are responsible to the Minister of Mines and Minerals in so far as administration is concerned. The Act provides that no appeals may be taken from the Board's orders but provision is made for the Board to review, alter or vary any of its orders or directions.

Section 12 of the Act provides that no operator -- defined as a person having the right to a mineral -- may enter on the surface of land without having either the consent of the owner, or an order of the Board granting him the right to enter, use or take the surface of the land. It is obligatory that the operator attempt to reach an agreement with the surface owner and not until he has done so may he apply to the Board.

Applications to the Board must be accompanied by a plan or description of the land required and copies must be served on any person whose interest in the land is affected who then has seven days in which to register an objection with the Board.

Operators may be given the right to enter and use the land at the conclusion of the seven day period or may be required to wait until a hearing is held. In the first case, a hearing is held as soon as possible after an order is



given to determine compensation. In this, the Board considers the value of the land, possible damage of a permanent nature, inconvenience, and general disturbance. The hearing to determine compensation can be held either before or after the entry of the operator on the land.

The amount of compensation granted varies from case to case depending on the nature of the soil, damages to crops, inconvenience caused by severance, noise and any other factors which the Board deems it advisable to consider.

A typical case would be where an operator required five acres in a quarter section of cultivated land for a well site, access road and flow line. The compensation would be given firstly as to the taking of the land, possible damage, disturbance and inconvenience in one lump sum and secondly, in yearly payments for continuing loss of use of the land and inconvenience. In this case the farmer might receive a lump sum of from one thousand to fourteen hundred dollars and a yearly payment from then on of from two hundred to four hundred dollars until the Board terminates the right of entry.

The most common cases involve well sites, access roads and flow lines although land required for short power lines necessary for the mineral operations may be given. In 1957 approximately



thirteen hundred applications were heard involving some seventeen hundred sites for wells or other installations.

The interest in the land which the operator receives is every right except the right to a certificate of title subject to any conditions imposed by the Board such as the maintenance of fences or the right of the owner to the use of a road.

A distinction is made between Crown land and private land in that in the case of Crown land the operator may go to the Board in the first instance rather than deal with the government Department concerned. Compensation payable to the Crown since it is usually for vacant land in the more remote areas is considerably lower than that payable to private owners unless there is destruction of valuable timber when compensation is determined accordingly.

While the compensation determined by the Board may be higher or lower in any particular area than the operator has initially offered to the surface owner, in practice, the compensation set by the Board has the effect of stabilizing values in that area. The Board's operations over the years have removed to a large degree in Alberta the contentiousness which may exist between surface owners and mineral operators.



PIPE LINES

The Pipe Line Act in Alberta will be an exhibit.

MR. PATTERSON: The Pipe Line Act in Alberta, Mr. Chairman, will be Exhibit C-3-2-W.

---EXHIBIT NO. C-3-2-W: The Pipe Line Act in Alberta.

MR. SOMERVILLE: The Pipe Line Act in Alberta (Exhibit C-3-2-W) is under the administration of the Department of Mines and Minerals. Generally it governs the construction and operation of main gas and oil transmission lines within the Province, gathering lines and pipe lines used for various operations relating to the drilling and production of oil and gas wells.

GAS LINES AND OIL LINES

Gas transmission lines are those constructed or being constructed for the transmission of gas from the various gas fields to interprovincial pipe lines or to a distribution system for ultimate consumers. Before construction can be commenced, an application must be made to the Minister of Mines and Minerals indicating the proposed route and giving the specifications of the pipe, etc. Copies of the application are filed with the Oil and Gas Conservation Board and the Minister of Highways. Before granting a permit to construct a gas line the Minister considers any



recommendations or objections which the Board or the Minister of Highways may make and objections of other interested parties.

After the granting of a permit, the permittee may proceed to acquire whatever interests in the land that he requires for the pipe line. If the permittee is unable to do this by contract with the land owner, he may apply to the Board of Public Utility Commissioners. On completion of construction the permittee makes an application to the same Board for an order permitting him to operate the line. The Board requires evidence that the line has been satisfactorily tested before the order is issued.

Main oil transmission lines within the Province are those carrying oil to interprovincial lines or to refineries from fields. The procedure as to permits and operation are for the most part similar to that applicable to gas lines. In both cases advertising of an intended application and the proposed route of the pipe line is required under the Act although the Minister may exempt an applicant from this requirement. A map showing main oil and gas lines is provided and will be an exhibit.

MR. PATTERSON: Exhibit C-3-2-X, Mr. Chairman.

---EXHIBIT NO. C-3-2-X: Map showing main oil and gas lines.

MR. SOMERVILLE: Gathering Lines: Under



the present Act gathering lines are exempt from those provisions pertaining to permits and orders permitting operation. Gathering lines, as their name implies, are used to collect and gather oil or gas in producing fields preparatory to entry into a main line. Another type of line, called service lines, are used for carrying oil, gas or water required for operations conducted in fields for secondary recovery, water injection or disposal schemes and services pertaining to various drilling and production operations. Service lines are dealt with under the Act in the same manner as gathering lines. The right to take land required for gathering lines and service lines follows the same procedure as that for main lines.

FLOW LINES

A special category of pipe line known as a "flow line" is used for carrying oil from a well to a tank or tank battery in close proximity to it. The right to land required for flow lines where agreement with the owner cannot be reached is obtained from the Board of Arbitration under The Right of Entry Arbitration Act.

LAND REQUIRED

Except for flow lines, where the Crown is the owner of land required for a pipe line, the operator is required to apply to the Board of Public Utility Commissioners. Where the land is privately owned, the



great majority of land acquisitions are settled by agreement. There are no fees payable for permits or for the various orders obtained. The compensation payable to the Crown for land taken is generally lower than that payable for private land except where valuable timber stands are affected when compensation for destruction of timber is taken into consideration.

GENERAL

It is impossible to give the total pipe line mileage in Alberta. An operating licence system may be adopted which will establish a record of each line in the Province and the mileage may then be calculated.

The companies engaged in constructing and operating pipe lines in the Province fall generally into three classes:

- (a) the pipe line company which constructs and operates the main lines and their attendant gathering lines,
- (b) pipe line companies which are subsidiaries of oil companies and which construct and operate pipe lines to carry oil or gas to refineries, and
- (c) the producing companies themselves which construct and operate flow lines, gathering lines and service lines.

A pipe line may be declared "a common carrier" by



the Oil and Gas Conservation Board and if the charges cannot be agreed upon they may be fixed by the Board of Public Utility Commissioners.

If the pipe specifications are satisfactory for an oil line a permit is usually granted reasonably soon after receipt of the application. In the case of gas lines, it is customary for the Oil and Gas Conservation Board, before making its recommendation to the Minister, to hold a hearing and to consider all aspects of the case including interests of producers and consumers.

A decision of the Minister with respect to an application for a permit is final and not subject to review in any court of law.



MINERAL TAX

The Mineral Taxation Act has been filed as an exhibit.

MR. PATTERSON: Mr. Chairman, this is Exhibit C-3-3-2-Y.

---EXHIBIT NO. C-3-2-Y: The Mineral Taxation Act.

MR. SOMERVILLE: The Mineral Tax Act, Exhibit C-3-2-Y, applies generally to all minerals held in fee simple in the Province. It provides firstly for the levying of a tax on the owners of minerals based on acreage and secondly for the assessment and levying of a tax on minerals in producing areas.

In the first case -- the acreage tax -- the maximum rate prescribed under the Act is five cents per acre but may be fixed by the Lieutenant Governor in Council at a lesser rate. At the present time the rate is one and one-half cents an acre. The minimum tax payable is twenty-five cents.

In the second case -- the producing area tax -- the principal mineral within a producing area is assessed under the Act at the fair actual value which is computed in accordance with the following schedule:

1. The fair actual value for the purpose of assessment in any year of the petroleum within, upon or under the land allocated



by the Minister to a well producing petroleum or petroleum and natural gas shall be one and one-half times the value at the average field price during the first three months of the year in which the assessment is made of all petroleum produced from the well during the preceding year.

2. The fair actual value for the purpose of assessment in any year of the natural gas within, upon or under the land allocated by the Minister to a well producing either natural gas alone or both petroleum and natural gas shall be four times the value at three cents per thousand cubic feet of the natural gas produced from the well during the preceding year.

Where oil and gas is subject to a lease, it is customary for the lessee, to reimburse the mineral owner seven-eighths of the producing area tax. The only minerals in Alberta affected by the producing area tax are coal, oil and gas.

The Act provides that after an assessment has been made with respect to the producing area tax, the assessment roll be posted in specified places in Calgary and Edmonton. Any owner whose mineral has been assessed is then given the opportunity to appeal to the Alberta Assessment Appeal



Board.

Revenue collected by the Province under this Act for the fiscal years 1949 to 1957 is as follows::

<u>Year</u>	<u>Acreage Tax</u>	<u>Producing Are Tax</u>	<u>Total</u>
1949-50	\$297,883.10	\$ 452,838.16	\$ 750,721.26
1950-51	307,062.62	526,029.61	833,092.23
1951-1952	323,185.71	444,293.91	767,479.62
1952-53	310,285.08	572,671.45	882,956.53
1953-54	283,853.18	717,352.55	1,001,205.73
1954-55	277,842.74	1,031,913.72	1,309,756.46
1955-56	264,496.50	1,031,802.40	1,296,298.90
1956-57	<u>272,883.90</u>	<u>1,070,380.73</u>	<u>1,343,264.63</u>
	\$2,337,492.83	\$5,847,282.53	\$8,184,775.36

I shall be pleased to supply additional information on any aspect of the administration of the Department of Mines and Minerals that the Commissioners may desire. This concludes my submission.

All of which is respectfully submitted.

THE CHAIRMAN: Thank you very much, Mr. Somerville. It is very enlightening and excellent background material for the Commission and it is very well put together and fairly. Thank you, sir.

BY MR. PATTILLO (Cont'd):

Q. Mr. Somerville, might I ask you a



few questions to explain some of the comments you have made which would be very clear to you but are not as clear to me. Will you look at page 4 of your submission?

A. Yes.

Q. In the second paragraph you refer to two patents being the Waterton Lakes National Park. Approximately in what part of the province is that park situated?

A. It is in the extreme southwest corner. It appears in this portion of Alberta (indicating on map).

Q. In the extreme southwest corner. And you refer also to Bow Island. Where is Bow Island?

A. It is in this area (indicating).

Q. Can you give us anything more clearly than that? Would it be in the vicinity of Lethbridge?

A. In the general area between Lethbridge and Medicine Hat.

THE CHAIRMAN: Would it not show on the large area?

MR. FRAWLEY: Would you like Mr. Somerville to give you a description of it? He could have that later.

Q. You also refer to the Athabaska River and McMurray?

A. It is indicated on this map of the



bituminous sand area.

Q. And it appears on the large map there where we have the large green portion in the northeast corner of the province?

A. Those particular areas you speak of are coloured red on this bituminous map.

Q. On page 4 you were speaking about the first regulations governing the leasing of petroleum natural gas coming into being in 1910. When you said the regulations applied to Dominion lands in Alberta, did they apply only to Dominion lands and not to school lands or lands then owned by private individuals?

A. They just belonged to lands that were held by Canada; petroleum natural rights held by Canada. They were not school lands. They did not apply to petroleum natural gas included in patent.

Q. Would you explain to us what you mean by the phrase "School lands"?

A. Do you want just a casual comment or would you rather have something written going back to the point where school lands started? I could, probably, communicate with federal authorities.

Q. I do not think we need to go as deeply as that into it but there are several references here to school lands.

A. School lands, normally, cover



sections 11 and 29 in each township as it became surveyed and the revenues derived from the disposal of school lands, if they were capital revenues, were placed in a trust fund; other types of trust funds were used for the benefit of schools. In fact, capital account is also used for the benefit of schools in grants that are made by the Government to the individual schools.

Q. You mentioned those two numbers of sections in the township. In Alberta are there certain numbers of sections in each township?

A. Yes.

Q. How many are there?

A. Thirty-six sections, and a section is approximately a one-mile square.

Q. On page 9 you show at the top a table showing the acreage altogether in the province as 163 million acres and some odd, and, as I understand it, these figures are merely dealing with the ownership of the mineral rights in those acres?

A. Yes.

Q. At the time of the transfer?

A. Yes. The purpose for which it is here is because this deals with petroleum and natural gas.

Q. Where you say, later on page 9, the railway companies were granted approximately sixteen sections in each township in certain areas in the



province, was there a formula followed in connection with that similar to the school lands where they were given certain numbered sections? Were the railways given certain numbered sections?

A. To a degree. It is true that the federal government reserve for disposal the odd number of sections excepting the two school sections 11 and 29 and you will find most of the railway grants were confined to an odd number of sections excepting 11 and 29. Some of the railways obtained the right to have other sections within twenty-five miles of the line. Some were just twenty miles and then there were some railways that did not get any.

Q. On page 10 you make a comment, in the last paragraph, with the advancing of geological and geophysical methods of locating structures suitable for oil accumulation it became apparent that prospect permits did not cover adequate acreage; so that, in January, 1936, regulations were amended permitting the size of various grants to be in the discretion of the Minister instead of the maximum area of 1,920 acres that prevailed before. Would you care to explain to us why it became apparent that prospector permits did not cover adequate acreage?

A. The prospecting permits in effect before that time covered an area one mile by three miles and with the advancement and the application of



the sciences it was found there were certain types that could not be found to reasonably apply to such a limited area. In order to investigate an area one mile by three miles you would have to go back some miles on each side of it.

Q. On page 11, the first complete paragraph, you say:

"In September, 1937, the prospecting
"permit regulations were rescinded
"and replaced by regulations covering
"petroleum and natural gas reservations
"allowing up to 50,000 acres to be
"included in a reservation."

Will you just explain for the record what a reservation is?

A. A reservation is, actually, a prospecting permit. It was felt, in 1937, that a number of prospecting permits in existence and with the change in procedure that it would be advisable, from an administrative point of view, to choose another name so there would be a definite demarcation between each type of disposal and that is why the word "reservation" was chosen in place of "prospecting permit".

Q. On the same page, page 11, paragraph 3: New regulations were established in August, 1941, and you say the areas obtainable under lease by application were increased from 1,920 to 9,600 acres.



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The number of acres to be included in a group for drilling was reduced to 19,200. Would you please explain for the record what you mean by "a group for drilling"?

(Page 96 follows)



A. If the lessee had more than one petroleum and natural gas lease he could drill a well on one of the leases which would, during the period of drilling and for a reasonable period thereafter, honour the obligation on each of the individual leases to drill a well.

Q. Now, at the top of page 12 and at the bottom of page 11 you say:

"In August of the same year ..." --
that is, 1947 --

"... new lease regulations were established increasing the maximum size of a lease to sixteen sections or 10,240 acres and requiring the creation of a Crown reserve of equal acreage in close proximity to the lease. This meant that anyone applying for leases in an area held under reservation could acquire not in excess of 50% of the lands contained in the reservation."

Would you care to explain that a little more, Mr. Somerville?

A. Well, let us assume that someone had a reservation that was, possibly, 12 miles square -- that would be four townships. When the holder of the reservation decided to apply for a lease he could determine the lease areas that he would like in the form of a square, 4 miles by 4 miles, which, in total,



would embrace sixteen sections. Those blocks had to be a mile apart, but they were permitted to corner, and the portions that he could not lease became a Crown reservation and were acreages in close proximity to the lease.

Q. And it would be these Crown reservations that would be subsequently put up for tender?

A. Yes.

Q. Now, on page 13 in the third paragraph you say:

"The royalty on natural gas for the ten-year period commencing June 1, 1941, was 15% of the selling price subject to a minimum royalty of one-quarter of one cent per thousand cubic feet. The minimum royalty on natural gas was increased on March 30, 1948, to three-quarters of one cent per thousand cubic feet."

What was the practice? Did you charge the minimum, or somewhere between the minimum and the allowable maximum?

A. No. Actually, the rate of royalty was 15%, but when in calculating the 15% you arrived at an amount of less than one-quarter of one cent per thousand cubic feet until March 30, 1948 then the royalty was one-quarter of one cent per thousand cubic feet, and the same applied with the minimum of three-quarters of one cent per thousand cubic feet



after March 30, 1948.

Q. I see. Now, on page 14 where you are talking about the royalty on crude oil you say:

"In summary the royalty on crude oil is
"16 $\frac{2}{3}\%$ for wells producing over 4,050
"barrels a month, decreasing to 12 $\frac{1}{2}\%$ when
"the monthly production is 1,500 to 1,800
"barrels decreasing to 5% at 600 barrels
"a month."

Were those calculations based on actual production or on the allowables that you were permitting?

A. Actual production.

Q. In the next paragraph you say:

"The royalty on natural gas or residue gas
"sold or consumed for some useful purpose
"is 15% of the selling price of fair
"value ..."

Now, when there is not a selling price is that when the test of "fair value" is employed, or if there is a selling price do you still on occasion say: "We will not accept the selling price but we will determine what the fair value is"?

A. The regulations that were exhibited include a provision that until otherwise ordered by the Minister the sale -- each sale -- includes the Crown royalty share, so if the Minister chose to move from the position of accepting a royalty calculated on the selling price he would have to otherwise order.



There are some cases where natural gas is physically not sold, in which case a fair value is set for royalty purposes.

Q. Now, on page 16 at the top of the page you use some phrases which I would ask you to be kind enough to explain for the record. For example, you use the phrase "proven or semi-proven areas". Would you explain what you mean by a "proven" area, and what you mean by a "semi-proven" area?

A. Well, those are names that signify that the acreage is reasonably close to, or between, producing wells.

Q. And when you use the phrase "unproven area", what do you mean by that?

A. That is often referred to as "wild-cat acreage".

Q. And "reservations in Provincial reserves" -- what does that phrase mean?

A. That means the disposal of a petroleum and natural gas reservation in an area that is included in a Provincial reserve. The form of notice was tabled. This is one here (indicating).

Q. Is a Provincial reserve something like a Provincial park?

A. I think there is a similarity, as you suggest. The Provincial reserves are restricted from the normal application of the regulations in much the same way as any Provincial park. There is usually



not quite as much freedom in it, but it is there for an unspecified purpose. In these particular areas the petroleum and natural gas rights are not available for application at the appropriate office in the Department for lease or reservation. If at any time the petroleum and natural gas rights are to be disposed of then it is by advertisement in the Press at a Crown Reserve sale.

Q. And, specifically separated from advertisements relating to sales of other lands --- or, minerals, rather?

A. Yes.

Q. Now, at the bottom of page 16 under the sub-heading "Dispositions" you say:

"Mention is made that each petroleum and
"natural gas lease issued followed May 15,
"1948 and each natural gas lease includes
"a covenant by the lessee that natural gas
"taken from the lease shall be used within
"the Province of Alberta unless the con-
"sent of the Lieutenant Governor in Council
"to its use elsewhere is obtained, con-
"sent is given after a permit is obtained
"authorizing the removal of the gas from
"the Province under the Gas Resources
"Preservation Act."

I was just going to ask you if you would develop that a bit for us, but I observe that it is time for



adjournment and, perhaps, you would not mind dealing with that after lunch.

A. I would be pleased to.

THE CHAIRMAN: We will now adjourn, gentlemen, until 2.00 o'clock this afternoon.

MR. PARKINSON: I am advised, gentlemen, that the doors will be locked during the adjournment so that if anyone wants to leave documents on the table they may do so.

---Whereupon the hearing adjourned at 12.30 P.M.
until 2.00 P.M.



AA

---Upon resuming at 2.00 P.M.:

THE CHAIRMAN: Well, gentlemen, we will now resume our hearing. Mr. Pattillo?

MR. PATTILLO: Q. Mr. Somerville, just on adjournment I was asking you if you would explain the first paragraph under the sub-head, the dispositions appearing at the bottom of page 16 and the top of page 17.

A. I wonder, sir, if I could suggest that reference be made to Exhibit C-3-2-Q, which is the natural gas lease?

Q. Yes?

A. Section 9 of the lessee's covenants, which sets out the information in a little more detail. Section 9 reads that the lessee covenants and it is an expressed condition upon which this lease is granted that natural gas taken from the lands herein described shall be used within the Province of Alberta unless the consent of the Lieutenant Governor in Council to its use elsewhere has been previously obtained.

Then that is followed by the sentence that if there is any breach to this occurring, the lease may be cancelled.

Q. Has that clause, to your knowledge, ever been invoked?

A. Do you mean the cancellation?



Q. Yes.

A. No.

Q. Now, immediately under that, on page 17, you refer to the various types of disposals with the year of their first coming into being, and I wonder if you would explain the difference between 2 and 3, that is, the petroleum natural gas reservation, as opposed to the Crown reserve drilling reservation.

A. Taking, first, the petroleum and natural gas reservation, that was a type of prospecting permit and it applied to areas that were already available to an applicant, or, in some cases, that were advertised as Crown reserves in the Provincial reserve areas.

The basic requirement there was the performance of work during the period of reservation and, at the conclusion of the reservation, if the work was satisfactorily performed, the holder of the reservation could expect to lease up to 50% of the lands in the reservation.

The Crown reserve drilling reservation is a form of secondary reservation that only applies to those areas in which the petroleum and natural gas rights are Crown reserves.

The drilling reservation covers a lesser extent of land. Under the notices of sales that were filed, you will find that the extent of a Crown reserve



drilling reservation may be from six sections to about twenty sections of land.

The requirement is that a well must be drilled to a specified depth that is indicated in the notice of sale or to a zone in which the commercial production of ore was obtained. In compliance with the drilling requirement, the holder of a reservation is entitled to lease the petroleum and natural gas rights in the number of quarter sections that are specified in the notice of sale. The number of quarter sections ranges from six to sixteen; that has been our policy in the past.

Q. Would you explain the distinction between a natural gas licence and a Crown reserve natural gas licence?

A. A natural gas licence emanates from a petroleum and natural gas reservation. In exploring on his reservation, if the holder is successful in finding gas and is unsuccessful in finding oil, he may apply for a natural gas licence of the zone or zones in which the natural gas was found within such area or all of the petroleum and natural gas reservation as he may select.

Q. Supposing that a person has had a petroleum and natural gas reservation and has been unsuccessful in finding oil but has found natural gas and he applies for this natural gas licence, does that preclude the Crown from giving a further



petroleum reservation to anybody over that same area?

Supposing somebody else thought that an error had been made in looking for oil and they didn't go deep enough or something of that nature and they thought there was some oil available in that area.

A. I should explain that when the holder of a petroleum and natural gas reservation makes his application for the natural gas licence on a zone or zones, he must surrender the natural gas in the zone or zones applied for out of the reservation, so that the Crown is then in a position of granting natural gas licences, and you often find that the holder of a licence continues to hold all of the remaining rights under the reservation, and at the conclusion of the reservation he is still permitted to acquire leases in the normal way, up to 50% of the lands with the exception that the natural gas included in the natural gas licence is excluded out of each lease.

Then, following your suggestion, if those petroleum and natural gas sales are cancelled, subsequently, or if application had not been made for leases out of the petroleum and natural gas reservation, then the Department may advertise the acreage to become available against either that petroleum and natural gas lease or the petroleum



and natural gas reservation, subject to the exclusion of the gas in the zone or zones.

Q. Would you just explain the Crown reserve natural gas licence?

A. The Crown reserve natural gas licence is also in the category of being referred to occasionally as a secondary form of licence. It pertains only to Crown reserve areas, and with that type of licence there is no defined zone to which the holder of the licence must drill. He has freedom in drilling to whatever depth he wishes and his leases that he may get out of the Crown reserve natural gas licence depend on, actually, two things: that he found gas and then, for each completed gas well, he is entitled to a specified number of sections under a gas lease.

Q. When we were talking this morning about the Crown reserves and when we are using the words here, we are still talking about the same thing, and would you show it on the map as being in the red squares?

A. That is one type of reserve, one type of Crown reserve.

Q. What is the other type?

A. The other types are fractional areas of less than one-quarter section.

Q. Yes?

A. The next type is an area close to a



lease of the same size, and then the final one is the 50% of the lands in the reservation that the holder of the reservation is precluded from leasing.

Q. And all of those are included in the words "Crown reserve"?

A. Yes.

Q. Might I ask you this question: as to one category of Crown reserve, that is that portion that you showed us this morning, being encompassed on the map in red lines, what is the acreage of those lands?

A. It is 12,878 square miles, which, multiplied by 640, would give you the figure in acreage. I'm sorry, but I have not calculated it.

Q. You stick me to do that.

Now, may I ask you: of that amount of land, how much of it, up to the present time, has been permitted to be under reservation or lease or licence?

A. I would say between 40 and 50% has been offered for sale and disposed of as reservations of petroleum natural gas rights.

I might point out at this time that there is a defence area that is set aside for the Federal Government that takes in more than this portion here (indicating).

Q. When you say "this portion", you are



again referring to the exhibit ---

A. This is Provincial reserve, in here (indicating).

Q. And you are pointing to approximately mid-way on the map, near the right border?

A. Yes.

Q. The right hand border or the eastern border of Alberta?

A. Yes.

Q. And that is on Exhibit 2-F?

A. Yes.

Q. Now, at the bottom of page 17 and at the immediate top of page 18, you give us some statistics regarding the nature of disposition as at December 31, 1957. Now, in connection with those calculations, have you any idea what percent of the acreage shown would be Crown and what percent would be school lands?

A. Since the Fall of 1941 we have not maintained those records.

Q. You have not distinguished between them since 1941?

A. From 1941 on there has just been one type of regulation which applied to both Provincial rights and school rights.

Q. Have you any records which would supplement these figures which we have here as to the nature of disposition of lands belonging to



other than the Crown or the Province ---

A. No. The Department has no record of freehold disposals.

Q. They do not attempt to keep a record of that information?

A. No.

Q. Now, mid-way in page 18 you use a phrase, I think, for the first time, "bonuses received for rights offered under the preceding paragraph".

Now, what do you mean by the word "bonuses"?

A. The notice of sale for the disposal of areas under lease or under petroleum and natural gas reservation provided that the tender must be accompanied by a cash bonus, and the cash bonuses that have been accepted during each of the years are indicated in total on that particular exhibit.

Q. Do you mean, in other words, that the amount that I paid for the rights which I am seeking to get with my tender, is that the amount, or is it in addition to my tender price?

A. Well, we approach it from a little different aspect. We assume that the tender is the actual letter that is supplied to us. One of the things that accompanies the tender is the bonus and the other is the fee, and the rental in the first year and so on. The bonus is the item that is



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considered in determining which is the higher
offer.

(Page 112 follows)



Q. Well, really the bonus is the amount paid for the **right** to get the lease?

A. That is right.

Q. At the bottom of page 32 you use the expression, "areas defined as restricted areas by the Minister of Mines and Minerals": I assume that those would include the lands which were shown on the map, 2-F, and which were marked out in red?

A. No, those areas are available for anyone to go in and conduct a geophysical or geological exploration. The areas referred to in (d) up to the present are just areas in which water wells located to supply a community, or village or town, and there is a barrier area that is created so that the water supply may not be affected by the geophysical exploration.

Q. Can you give us any idea as to the extent of acreage on those areas in the province?

A. I would say about 7,000 or 8,000 acres in total all over the province.

Q. On page 33, under Part VIII, in the first paragraph, and the last sentence, where you say that the Minister may refuse to register a transfer where registration would result in more than five persons becoming the holders of the agreement or where the specified undivided interest is less than a ten per cent interest, does the Minister, in fact, do so?



A. I can't recall any instance where it is done, although there are not many instances where this provision applies. Actually, I think from the establishment of these provisions a year ago that industry now is, you might say, restricting these transfers to conform with these exceptional cases. Before that time there were documents which were previously known as assignments, which covered lesser interests where there were more than five people that would be the assignee. We have acknowledged those documents and registered them and they have been presented to us.

Q. At the bottom of page 33 you use the phrase, "farm-out agreements": would you please explain what you mean by that phrase?

A. That is a phrase that has been used quite freely in industry, and I believe it mainly intends to convey that the holder of the properties, whether freehold or Crown, transfers an interest to someone else upon his doing a certain amount of work or drilling, or the expenditure of funds, or something along that line.

Q. On page 34, immediately under the subhead "Part IX" you talk about a unit operation: would you please explain a unit operation, and how it comes about that the Crown becomes a party to a unit agreement?

A. Let us say that there are three areas:



A, the owner is the Crown, and the owners of B area and C area are subjects of Her Majesty; in the interests of applying conservation methods in the greatest ultimate recovery, pressure maintenance and so on, you find that those three lessors plus the lessees, whoever they may be -- and there may only be one or two or three -- will enter into an agreement which, in fact, suggests that the three areas will in future be considered as one unit as though all of the land was held by one lessor and granted to one lessee; and the agreement goes on further and it permits the spacing of wells rather than along the geographical lines, more along geological lines, if the wells are placed at points which the operator feels will be to the best advantage. In Alberta, in the three areas, there may be 40 spacing units on which one well could be drilled. You may find under the unit operation that ten wells may be used to recover the oil or gas, and some other wells may be used for injection of either water or gas into the formation.

Q. You used a phrase there, about using geological rather than geographical in this location of the wells: would you explain what you mean about that geographical differential?

A. In Alberta, in a spacing unit there is a defined point at which the well should be drilled to drain the oil from that spacing unit. Under a unit operation you may find that none of the wells



fall at the points that would be drilled if the unit operation was not completed.

Q. And would you further explain, what is that point if you don't have the unit operation in Alberta -- the geographical point of spacing? Can you explain that?

A. In a spacing unit of a legal subdivision, which is a square area of approximately 1,320 feet, the well has to be located 660 feet in from each of the sides, which actually places it in the centre.

Q. On page 36, at the bottom of the page, you refer to, "the royalty shall be at such rate as may be prescribed from time to time by the Lieutenant Governor in Council on each of the products derived from the bituminous sands . . .": what are the products that are presently being derived in Alberta from the bituminous sands?

A. Well, there are none at the present time.

Q. None, you say?

A. Yes.

Q. May I direct your attention now to the part of the brief commencing at page 42, relating to pipe lines, and at the bottom of page 44 you say, "It is impossible to give the total pipe line mileage in Alberta". Now, why is that?

A. Well, up to the present time the



procedure that has been followed in Alberta has been the granting of a permit for the construction of the line, and when the line is actually constructed along the ground it doesn't follow exactly the general line that was shown on the sketch that supported the application. So, if we assume that a line is twenty miles long on the application made to construct it, in fact you may find it is twenty and a half miles long, or might even be a little shorter, when it is actually constructed.

The next suggestion there is that it is contemplated there will be an operating licence system adopted whereby anyone that operates a line will have to file with us a plan of survey, and when we have those plans of survey the lines will be measured and the totals aggregated to determine the total mileage in the province.

Q. You don't have a system of taxation here on pipe lines such as in Ontario, where they would have to disclose exactly how many miles of pipe each taxpayer owned in the province?

A. I believe that is dealt with in our tax rental agreement with the Federal Government.

Q. On page 45, in the middle of the page:

"A pipe line may declared a

"'common carrier' by the Oil and

"Gas Conservation Board and if the



"charges cannot be agreed upon

"they may be fixed by the Board of

"Public Utility Commissioners."

Has any pipe line in the Province of Alberta, to
your knowledge, been declared a common carrier?

A. I can't answer that, sir. I be-
lieve that will be dealt with in the submission from
the Oil and Gas Conservation Board that will follow.

(Page 118 follows)



Q. Then this statement: if the charges cannot be agreed upon -- agreed upon by whom?

A. By the pipeline owner and the person putting the product through.

Q. Do you know of any instance where the charges have been fixed by the Board of Public Utility Commissioners rather than by agreement?

A. Not in recent years, I cannot recall any. I would like to mention at this point the Department just took over the administration of the Pipe Lines Act on the first of April, 1957.

Q. On page 47 you say where oil and gas is subject to a lease it is customary for the lessee to reimburse the mineral owner for seven-eighths of the producing area tax. The only minerals in Alberta affected by the producer area tax are coal, oil and gas. Would you please explain that? Do I understand by that, if I am the owner, as a private citizen, of certain mineral rights, having gotten them before it was permitted to be given to my predecessor in title and I lease them, that the tax imposed on me in the first instance -- that it is customary for the lessee to reimburse me to the extent of seven-eighths? Is that what you are saying there?

A. Yes.

Q. What is the situation if the owner is the Crown?



A. Then the mineral is not subject to taxation under the Mineral Taxation Act.

Q. So that these revenues collected were to relate to lands other than the land owned by the Crown; is that it?

A. That is right.

Q. Mr. Somerville, would you please look for a moment at page 9? Am I correct in thinking that insofar as the mineral rights are concerned, that there are 163,000,000 acres in the Province and of those only approximately 31,000,000 belong to other than the Province itself?

A. That is correct.

Q. May I just ask you a few questions regarding Crown reserves and the disposal of them? What is the practice as to the timing of these reserve sales? Are they held periodically or how?

A. The sales pertain to items one, two and three on page 16 of the brief and I might just read it:

"1. Leases in proven or semi-proven
"areas.

"2. Leases in unproven areas.

"3. Reservations in Provincial reserves."

Those three may occur in the months of January, April, July and October. Anyone requesting a disposal of item 1, 2 or 3 would let us know six weeks prior, about a month and a half prior to the month



in which the sale occurs, and the advertisements usually are from about 35 to 40 days.

Q. Is it the practice of the Crown, if any request for any disposal of any one of those three was made, to follow out the request and then put the matter up for bid in any one of those months?

A. Yes. May I proceed, Mr. Pattillo?

Q. Yes.

A. The next one, Crown reserves, dealing with reservations, we usually have an advertisement for the sale at a time when there are about ten requests or thereabouts. Some of the sales, of course, often have more than ten requests because during the few days it takes to process the sale other requests come in in the meantime. Natural gas licences follow the same pattern although we do not wait until we have ten requests. Sometimes we advertise if we have one if it seems that there will be a lengthy period before the next request is received.

Q. What has been the experience of the Government of the price paid per acre in these disposals? Has there been a steady trend upwards, has it been levelling off, or has there been any downward swing?

A. I would think any downward swing is indicated by less attractive acreage being offered



for sale in the outskirts of Provincial areas. I do not think there is any trend indicated even in our last sale.

Q. Has the trend been steadily upwards or has it, more or less, in the last couple of years been at a level?

A. I think it could be said it has been on the level for even longer than two years.

Q. Thank you, Mr. Somerville. I have no further questions.

Mr. Frawley, would you care to re-examine Mr. Somerville?

MR. FRAWLEY: Thank you, I have no re-examination.

THE CHAIRMAN: Mr. Somerville, there is one little point I did not understand when you answered Mr. Pattillo about the 31,000,000 acres; is it that you are speaking as of the date of the transfer of that land in 1930 to the Province? That is not the situation today, is it?

A. Yes, that is the situation today. The statement pertained to ownership by lease granted under lease or other form of disposal.

Q. You confine it to ownership?

A. Yes.

Q. You said that the Pipe Lines Act only came under the administration of your Department on the first of April, 1957.



A. Yes.

Q. Under whose administration did it formerly come?

A. It was under the Minister of Highways from 1952 to 1957.

Q. There is another question I would like to ask, if I might. I do not know whether you are concerned about it. On page 36, when you speak about the bituminous sands, is it that that has not been developed because no method of processing the sands has yet been found feasible?

A. Well, no process has been applied on an economic basis in the area yet.

Q. It seems that I have read -- and this is wholly newspaper reading -- that through the National Research Council in Ottawa or the Department of Mines and Natural Resources in Ottawa that a process had been developed and had been given to some companies. I believe it is a secret process and I am not trying to inquire into that, but merely to get my ideas straight to test its economic worth. Do you know anything about that?

A. No, I do not, sir. I know the Department of Mines and Technical Surveys has been involved in a research to recover the oil and other products in the sands and I do not know just to what degree their experiments have been concluded.

Q. Then you did not see the newspaper



report?

A. I think I did.

Q. I could not find anybody, in conversation, who had seen it, and I wanted to get my own recollection straight.

A. At the present time there is only one small private plant that is in the experimental stage in the area, and that is being operated in the Bitumont area some 40 miles up the river from McMurray.

Q. Thank you very much, sir.

Would any members of the Commission like to ask Mr. Somerville any questions?

(Page 124 follows)



MR. COMMISSIONER HARDY: Mr. Chairman, I wonder if I could ask Mr. Somerville for a little explanation of the tabulations on page 17? It reads that on December 31st, 1957, the number and acreage of leases, reservations and licences actually in force on that date was so-and-so.

Q. Now, does that include everything that ever has been in force since 1910?

A. No, those are just the ones that are in an active status that were in existence on that day.

Q. Could you give us any idea, then, as to the acreage that, perhaps, has lapsed? What I am specifically trying to get at is: Can you give us any information, or can we get it out of the data that you have submitted, as to the percentage of the potential oil-bearing area in the province that has been held under a reservation of some sort since 1910?

A. Well, the area that was -- here is the map. Now, there may be, and, in fact, there are a few places within this general outline that have not been acquired under a petroleum and natural gas reservation, nor have been held under a petroleum and natural gas lease, but in general these are the borders in which reservations have been granted.

Q. It has been practically all taken out at some time or other for exploration?

A. Yes.



MR. PATTILO: Q. That is Exhibit -- what?

A. C-3-2-K.

MR. COMMISSIONER HARDY: Q. Then, these figures in the tabulation at the bottom of page 17 -- they include acreage which may be taken out for exploration for the first time, and also acreage which has been held for a second or, even, a third time?

A. That is right; as long as it is held it is an existing document.

MR. S. J. HELMAN: Mr. Chairman, I would like to ask the witness two questions by way of information only, if I may?

THE CHAIRMAN: Yes, certainly.

MR. HELMAN: Q. Mr. Somerville, going back to page 16 at the bottom where you deal with "Dispositions", and deal with the fact -- going over to page 17 -- that since 1948 natural gas leases have contained a provision that the natural gas taken from the lease shall be used within the Province of Alberta, can you give us any idea as to the percentage of the leases that have been issued that have that provision in them?

A. Well, the leases that have been issued -- I would rather say that about 85 per cent of our currently existing leases have the provision in them. That provision is in every natural gas lease, and it is in about 85 per cent of the petroleum and natural gas leases.



Q. And the statutes which you have filed in your material are not all the statutes dealing with petroleum and natural gas? You have only put in those that relate to your Department?

A. That is right.

Q. I am referring particularly to the Conservation Act and the Gas Resources Preservation Act and the Utilities Act?

A. I understand those will follow.

MR. HELMAN: Thank you.

MR. COMMISSIONER CUSHING: Q. Mr. Somerville, can I get a little further information on the tabulations? The tabulation on page 9 shows that Alberta had 132 million acres, and then according to the tabulation that Mr. Commissioner Hardy just referred to, which is on page 18, it is 75 million acres. Am I correct in thinking that the difference between those two totals is still held by the Government?

A. Yes, and is not granted under reservation or lease.

Q. It is for disposition or for sale at any time?

A. Yes.

Q. And then, from that, again, you would deduct the areas that you had in your reservations? You referred to a certain number of square miles, under 2-M, I think it was -- 12,878 square miles?

A. The portion of the provincial reserves



that have not been granted under lease or reservation would be included in the 132,000 acres, but excluded out of the 75,000,000 acres.

Q. It is still some of that difference -- that total in between ---

THE CHAIRMAN: Q. You meant, I think, 132,000,000 acres?

A. Yes, I did, sir.

MR. COMMISSIONER CUSHING: Q. Can it be presumed that since this difference has not been disposed of that it is mostly unexplored land, and possibly what we might call poor grade, or undeveloped?

A. Well, some of it is considered of poor grade, especially the northeastern portion of the province, and other lands within the area may be in a transitional period; there may be cancellations which have just been effected in the Department, and we have not proceeded with making the rights available for further disposition.

Q. On page 16 in regard to the five procedures, if an application is made under either 1, 2 or 3 is it necessary to hold a sale, or is that at the discretion of the Government?

A. Well, it is at the discretion of the Lieutenant Governor in Council, but up to now there has never been a sale held but what it was by public advertisement.

Q. I understood that under any of those



three items application could be made by interested parties before the sale?

A. That is true, yes.

Q. And then is it at the discretion of the Lieutenant Governor whether that sale be held at that time or not?

A. Yes.

Q. Is the normal procedure to go ahead with the sale after application is made?

A. It is. I might say, sir, that when I referred to the five types of disposal I chose the first three because they were in the category that fell into the four months of January, April, July and October.

Q. Then, you said that the trend of value has been fairly consistent over the years. Do we gather from that, then, that there were sales which were more numerous in 1956 than, say, in 1955 or 1957 because of the very large increase from petroleum and natural gas leases shown on Exhibit C-3-2-H? 1956 is some \$26 million higher than either the previous or the following year.

A. In 1956, sir?

Q. Yes, petroleum and natural gas leases in 1956, \$66,729,673.

A. Yes, but in 1956 -- that was when areas were extensively sold in the Pembina field.



Q. And it is presumed that there were more sales that year, and that is why ---

A. There were more parcels included, and then it is likely there were more sales in the one year.

Q. On page 39 when mentioning the Right of Entry Arbitration Act you specifically spell out that there is no appeal from the decisions of the Board. I assume the procedure follows from the Board of Public Utility Commissioners Act?

A. It may be. I have nothing to do with the administration of that Act.

Q. I notice that you did not mention that there was no right of appeal from that although you did in regard to the Right of Entry Arbitration Act.

A. Yes. The administration of the Right of Entry Arbitration Act comes under the Minister of Mines and Minerals.

Q. I am just wondering what happens -- and you mentioned the number of acres you have had -- what happens when a landowner refuses permission for a pipe line to cross his property, and the matter is taken to the Board of Public Utility Commissioners, which I understand is the procedure. Does that finalize it in the same way as it is finalized in the Right of Entry Arbitration Act?

A. Yes, it does.



MR. COMMISSIONER CUSHING: Then, there is no appeal from the Board of Public Utility Commissioners.

THE CHAIRMAN: Q. I do not think we should hold you to that answer because it does not come under your jurisdiction.

A. Well, actually the statute reflects back to Part I of the Public Utilities Act, and no doubt the provision is at some place in that statute.

MR. COMMISSIONER CUSHING: That is all I have.

THE CHAIRMAN: Mr. Ladner, do you wish to ask some questions?

MR. COMMISSIONER LADNER: Mr. Chairman, I have two questions. One relates to the revenue as shown in exhibits C-3-2-E, C-3-2-H and C-3-2-J, and the other relates to production -- that will be my second question.

Q. I would direct your attention to Exhibit 3-2-E, revenue to the province from royalties. You will observe -- and this, Mr. Cushing partly covered -- that in 1953 there are total revenues of \$16 million odd, and then they gradually went up to \$36 million odd. In Exhibit C-3-2-H, relating to the revenues to the province from sales of Crown reserves, you will observe that there is in 1953 about \$22 million, and then it jumps to \$64 million, \$62 million and \$72 million -- quite a substantial



increase. Then, referring to Exhibit C-3-2-J, revenues to the province from bonuses and rentals, you find an increase there except in the year 1955. Now, my question is: Is there any authoritative information, statistical or otherwise, respecting the probable revenues from those sources in the future, say in five, ten, twenty or thirty years, or a projection of probable production and reserves in the future, which would be a matter of interest to myself and perhaps to other members of the Commission? Is there such information available?

A. Well, the matter of production and reserves I believe will be dealt with in the submission of the Oil and Gas Conservation Board.

Q. That will be dealt with later?

A. Yes, in another submission.

Actually, turning to the statement of royalties, first, the royalties have generally increased until 1956, and at that time there is an indicated leveling off. Now, with more wells producing in the province, and without a commensurate increase in market, then you will find that each well will likely produce less barrels in the year than it did before, and when the production for a month is less then our rate of royalty is a little less. So, on the one hand you have more wells with a lesser rate of royalty applying to each well, and the one to a



degree offsets the other, and it will lend itself to a flattening off. With regard to Crown reserves, it all depends on the position of the acreage that is advertised, whether it is adjacent to extremely good oil wells or whether it is adjacent to fair oil wells, or whether it is adjacent to poor oil wells.

Q. It would appear from the statement that in 1953 the total with respect to Crown reserves was a little under \$23 million, and then there was a sudden jump to about \$65 million, and it remained there going as high as \$72 million. I was wondering if there was some event which brought that about, and I am more interested in what the future will bring about in that connection.

A. Well, in 1954 you will notice there was a considerable jump in the revenues from petroleum and natural gas reserves ---

Q. Yes, \$6 million odd.

A. --- that we sold.

MR. COMMISSIONER CUSHING: Now, it is \$30 million.

THE WITNESS: It went from \$3 million odd to more than \$32 million in 1954, and in that figure of \$32 million are included the two reserves we sold in the Pembina area of four townships which went for \$13 million odd and the other for \$11 million odd. I do not think that



there can be any forecast as to the future in regard to revenue from sales of Crown reserves because if another field like Pembina or Redwater were discovered then that would make a substantial increase in revenues.

Going to the exhibit on bonuses and rentals, the bonus portion, I think, is clear, being the moneys accepted for the right to acquire a lease or a reservation.

(Page 134 follows)



The rentals are the summation of the rentals of leases, reserves, licences, and so on, and I would imagine they will continue to follow much the same pattern, although you may find that there may be a levelling off there, too. After all, 58% of the Crown acreage is presently under disposal, and it may be that it will never be more than about 65% that will be under disposition.

MR. COMMISSIONER LADNER: Q. Well, in a little less than eleven years there is approximately \$724 million of revenue, and I was going to ask you: Does your Department from statistical information or other calculations make any estimate as to what it would be in the future, or does that relate entirely to production which we will hear about later on?

A. Well, every year we are called upon to make an estimate for the ensuing year, and that is as far as I have ever ventured.

THE CHAIRMAN: Thank you very much.

MR. PATTILLO: Mr. Chairman, may I ask one question I deliberately did not ask before because I hoped somebody else would ask it and I would not have to show my ignorance?

A. On page 12, at the bottom of the page, it reads:

"New royalty regulations came into effect on June 1, 1941, requiring that



"the royalty to be computed, levied
"and collected on all products, other
"than natural gas, obtained from a well
"would be that percentage of the pro-
"ducts obtained equivalent to the
"square root of the average daily
"production, subject to the proviso that
"with the first return for the well an
"election could be made to pay royalty
"until the end of May, 1951, at $12\frac{1}{2}\%$
"of all products, other than natural
"gas, instead of on the square root
"formula."

I wonder if you would just elaborate that by an example for me?

A. Well, let us assume that the average daily production from a well in the month of January was 100 barrels. If you take the square root of 100 you would end up with 10, and that would be the percentage. On the other hand, if you take 36 barrels as the average daily production in the month then the square root of 36 would be 6, so the percentage would be 6. Now, there was a minimum that prevailed of 5% and a maximum of 15%. It could not go above 15%, and it could not be less than 5%.

MR. PATTILLO: Thank you.

THE CHAIRMAN: Does that complete your



submission, Mr. Somerville?

THE WITNESS: Yes, it does, sir.

MR. PATTILLO: Mr. Chairman, that is as much as we have scheduled for today, and I would like to ask permission to have the hearing adjourned until 10.00 o'clock tomorrow morning, at which time we will be proceeding with Mr. Beach, who will be giving us a history up to the year 1947.

MR. PARKINSON: I just want to say, Mr. Chairman, that several members interested in the hearings have asked me for a schedule of subsequent hearings. I have a tentative schedule with me, and anyone who wants it can get it after.

THE CHAIRMAN: Does everyone hear? If anyone wishes a tentative schedule of the hearings they can speak to Mr. Parkinson after we adjourn.

Before we adjourn I would like to thank Mr. Somerville. He has been on the stand, and on his feet, all morning and all of this afternoon. You have been very patient, sir, and your brief is much appreciated by the Commission. Thank you very much.

We will adjourn now until tomorrow morning at 10.00 o'clock.

---Whereupon the hearing adjourned at 3.08 P.M.
until 10.00 A.M. Tuesday, 4th February, 1958.

ROYAL COMMISSION

ON

ENERGY

HEARINGS

HELD AT

CALGARY,

ALTA.

VOLUME No.: 2 DATE: FEB 4 1958

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ROYAL COMMISSION

ON

ENERGY

Hearings held at Calgary,
commencing Monday, February
3, 1958, at 10.00 A.M.

PRESENT:

Mr. H. Borden, C.M.G., Q.C.	--	Chairman
Mr. J.L. Levesque,	--	Member
Mr. G.E. Britnell,	--	Member
Mr. G.G. Cushing,	--	Member
Mr. R.D. Howland,	--	Member
Mr. L.J. Ladner, Q.C.	--	Member
Dr. R.M. Hardy,	--	Member

COMMISSION COUNSEL:

Mr. A.S. Pattillo, Q.C.

Mr. Miles H. Patterson.

Mr. J.F. Parkinson -- Secretary to the
Commission.

Major N. Lafrance -- Assistant Secretary
to the Commission.



APPEARANCES:

Mr. F.K. Beach,
presenting historical material and back-
ground relating to oil and gas and its
discovery in the Province of Alberta.

Representing the Oil and Gas Conservation
Board, Province of Alberta:

Mr. I.N. McKinnon	- Chairman
Mr. D.P. Goodall, P.Eng.	- Deputy Chairman
Dr. G.W. Govier, P.Eng.	- Member
Mr. N.A. Macleod	- Solicitor
Mr. D.R. Craig	- Reservoir (Oil) Engineer
Mr. J.R. Pow	- Geologist
Mr. J. Stabback	- Gas Engineer
Mr. A.F. Manyluk	- Development Engineer
Mr. R.J. Cooper	- Statistician

- - -



Tuesday,
February 4, 1958.

---On resuming at 10.00 a.m.

THE CHAIRMAN: Gentlemen, the Commission will now resume its hearings. Mr. Pattillo?

MR. PATTILLO: Mr. Chairman, I am calling Mr. Floyd Beach, who will be giving historical material and background relating to oil and gas and its discovery in the Province of Alberta up to the time of the discovery of the Leduc and, with your permission, I am asking Mr. Patterson to examine Mr. Beach.

F. K. BEACH, called

BY MR. PATTERSON:

Q. Mr. Beach, sir, would you be good enough, for the purposes of our record, to give us your full name?

A. Floyd Kellogg Beach.

Q. You are a resident of Calgary, I believe, sir?

A. Yes, sir, for many years.

Q. And you have a long association with oil and gas in Western Canada?

A. I have lived here for over fifty years but, for the last thirty years or more, I have been doing nothing else but oil and gas.

Q. And what have you done in this field,



if you will briefly outline that to us.

A. Starting about 1927 I joined the office of the civil mining engineer of the Department of the Interior and that was after I had been in other branches of the Dominion Government for some time, and it was about four years before the Province took over the control of the natural resources.

The transfer, actually, occurred in September, 1930, and it was early in 1931 that I joined the Province and was with them, as an engineer, until 1938, when I was moved to Calgary to the Petroleum Natural Gas Conservation Board. I remained with them until I went on pension early in 1950.

Since then I have been doing consulting work and western field editor for Canadian Oil and Gas Industries and consultant for the Imperial Bank of Canada, for oil and gas, and I collected a great deal of material that was used in their appraisal for gas reference in Alberta. I cannot say I have done the appraisal, myself; but I am quite intimately acquainted with it.

Q. Thank you, sir. Would you, then, let me have a copy of the historical material that we might file as an exhibit?

Thank you. That will be Exhibit C-4-1.



---EXHIBIT NO. C-4-1: Brief of Mr. Floyd K. Beach entitled "Historical Material for Royal Commission on Energy, Oil and Gas in Western Canada prior to 1947".

MR. PATTERSON (Continuing): Q. If you wouldn't mind, then, reading that material for us, Mr. Beach.

A. Before I start in, may I make a comment that a couple of days ago I heard a wisecrack on the radio that an oldtimer is someone who has forgotten more than others ever knew about some subjects and I am afraid that, because I have had to keep my material down to a limited time, that some of the highlights of the industry that I see around me here may think I have forgotten to put in a lot of the things which should have gone there. However, when I finish, I will be very happy to answer any questions that may arise, as best I can.

Sir Alexander Mackenzie traded with the Indians at Fort Chipewyan from 1781 to 1789, coming into that locality via Portage La Loche.

Dr. Sproule will point this out on the map. It is also called Methye Portage, because Methye Lake is right there, and he came down into the Clearwater River and he found the Clearwater River and Athabaska River and he recorded in his book that at about 24 miles below the forks of the two rivers, "are some bituminous fountains, into which a pole twenty feet long may be inserted without the least



resistance. The bitumen is in a fluid state, and when mixed with gum, or the resinous substance collected from the spruce fir, serves to gum the canoes . . . The banks of the river, which are elevated, discover veins of the same bituminous quality."

Mackenzie left Chipewyan on June 3, 1739, made his way to tidewater near the mouth of the river now bearing his name, which extends beyond the big map here, and on the return journey on July 24, noted pieces of "petroleum" -- now, in the text I have spelled that as "petroleum," as Mackenzie did, which is "ium."

This bears a resemblance to yellow wax, but is more friable. The exact locality of this find is somewhat difficult to place, but may have been somewhere near the present Norman Wells.

This intrepid explorer managed to get back to Fort Chipewyan just as ice began to form in the fall of 1789. His interest in the bituminous sands was evidently limited to their usefulness in boat building, and the waxy "petroleum" was merely a curiosity, reported among other observations of the country and its inhabitants, but the tar sands (or bituminous sands) have been exciting to many people since, as one of the greatest potential reserves of hydrocarbon on the continent, if not in the world.

The reference to "petroleum" may have had



some bearing on the Norman Wells discovery, although it was Lt. Col. J. K. Cornwall who spotted the seepage -- probably from leads given him by Indians -- and who tipped off some Calgary investors. They sent Dr. T. O. Bosworth, a geologist, to report on the land in 1914, or thereabouts, and Dr. Bosworth spent a mere eight days off the boat that took him north.

The references in the text refer to a bibliography at the end.

Hence we can say that Mackenzie's observation may have had a bearing on oil discovery, but at best a very remote bearing.

Before I go into developments in Western Canada, the circumstances preceding developments in the West are pertinent.

Whale oil was in use in lamps having wicks, but we picture such luxury reserved mostly for the rich. The poor depended on candles of animal fat. By the middle of the 19th Century whalers had to go so far that the price of whale oil rose to \$2.00 or \$2.50 per gallon and an alternative illuminant was needed. About 1841 a German chemist, Julius Liebig, forecast that the oil needed would come from mineral sources. In Scotland, James Young was working along similar lines and succeeded in distilling, from coal, oil suitable for illumination and also a product suitable for lubrication. In Nova Scotia Abraham Gesner attacked



the problem and distilled oil from coal, but found he could get better recovery by distilling Trinidad asphalt. By 1854 two large plants in New York were using the Gesner process for making kerosene from cannel coal and by 1860 some 56 plants were making kerosene by the same process.

Bitumen from the Trinidad pitch lake contained sulphur and if shipped in bulk as cargo it consolidated and had to be mined out of the ships' holds. Hence a search began for beds in North America that were free from sulphur. Two such beds were in southwestern Ontario. That is somewhere down in there (indicating on map).

Sir William Logan described them as beds formed by exposure of petroleum to air. J. M. Williams, a native of Scotland and acquainted with the work of James Young, was living in Hamilton, Ontario, and on hearing of these beds he went in 1857 to Black Creek and the following year erected a refinery nearby for making illuminating oil. He dug shafts four feet square and at a depth of 40 to 60 feet found gravel containing oil that could be pumped to the surface.

It would appear that Williams was not the first to try production of illuminating oil in Ontario, and that Charles N. Tripp produced some oil commercially in 1850 from beds near Oil Springs.

There is no record that Tripp actually



found oil that would float.

The widely hailed "first oil well" drilled by Col. Drake in Pennsylvania was in 1858. Where Williams found oil above bedrock, Drake's well was drilled into bedrock.

TECHNICAL DIFFICULTIES

Following the Williams well, drilling rather than digging for oil followed. Problems of casing drilled holes had to be met by various means, but it was not until a runaway well dumped a large volume of crude into Black Creek that means for controlling wells became apparently essential.

Transportation of crude oil became a problem in Pennsylvania and when a pipeline was laid it precipitated trouble among teamsters who had been hauling it in barrels.

Apparently the unions were at work.

Measurement of Oil: A problem in measurement of oil arose when oil was hauled in wooden barrels, which varied in size. A number of barrels were found to average 40 U.S. gallons in capacity. Since some oil slopped from open barrels it was decided to add 5 per cent for wastage, bringing the size of a barrel to 42 U.S. gallons. This figure, by the way, is equivalent to 35 Imperial gallons and is still in use.

Early refining of crude oil, both in Ontario and Pennsylvania, was directed toward supply



of illuminating oil and lubricants. The volatile fractions were a hazard in oil lamps and had to be wasted. With a start in manufacture of stationary gasoline engines late in the century, followed by the motor car shortly after, this trend changed.

Geological Thinking: Sir William Logan in 1843 and 1844 studied the Gaspe Peninsula. And that is there (indicating on map).

He found two springs or seepages, observing that they occurred on anticlines. In 1861, Dr. T. Sherry Hunt, a colleague of Logan, mentioned the anticlinal theory in a lecture in Montreal. Hunt was primarily a chemist but his name was linked with the theory that governed much exploration in western Canada.

Reservoirs for Oil and Gas: Now, early ideas were that oil and gas were contained in underground caverns. Actually, one such occurrence has been reported from Mexico where oil flowed out of control, its rate being limited only by casing capacity until exhausted, water pressure supplying the energy.

It is more usual for the reservoir to be porous rock. Sandstones have pores between sand grains and carbonate rocks (limestone and dolomites) have porosity between grains and in solution cavities (or vugs).

I come now to Early Search for Oil and



Gas in Western Canada. The first discovery of natural gas in Western Canada was at Medicine Hat in 1890 when the Canadian Pacific Railway was being built.

I quote from F. G. Clapp's book:

"In 1890 a well drilled at Medicine
"Hat in search of coal encountered a
"considerable supply of natural gas,
"the flow being so strong as to lead the
"town officials to take the matter up
"with the Canadian Pacific Railway with
"a view to drilling a deeper well for
"gas. Sir William Van Horne offered
"to lend the town a drilling machine,
"the town to stand the expense of
"drilling. A considerable flow of
"gas was encountered at about 650 feet,
"with a closed pressure of 250 pounds,
"but it was accompanied by a large amount
"of moisture. In the hope of obtaining
"a larger supply free of moisture,
"deeper wells were drilled and the pre-
"sent gas pay was developed in a well
"drilled by the city in 1905 at a depth
"of 1010 feet, showing a closed pressure
"of 500 pounds."

That is the end of Clapp's quotation.

The well drilled in 1905, according to
Clapp in another place, is dated as 1904 and is the



discovery year for the Medicine Hat gas sand.

Bow Island gas field was discovered in 1909 in a well drilled by C.P.R. and possibly the work was directed by Eugene Coste, though authority for that statement cannot be given except as hearsay.

As early as 1883 the C.P.R. drilled a well at 8th Siding, now known as Langevin, to get water for locomotives. It failed to get an adequate water supply, but found some gas, which burned the rig. Possibly some gas may have been used in a section house, but the reserves discovered were small.

In 1884 a Mr. Baring of Baring Brothers, bankers, London, England, came to Alberta and located a well site near Twin Butte (that is south of Pincher Creek), but seven years elapsed before drilling was undertaken by a Mr. Fernie, possibly the man for whom the town was named, and artesian water forced abandonment at 190 feet.



e B

An oil seepage on Cameron Brook (then known as Oil Creek) was known to the Indians. John George (Kootenai) Brown, ranching near, skimmed oil globules in 1886. Later, William Aldridge, who worked for Brown, dug trenches and pits into which oil seeped. He skimmed it for greasing farm machinery and sold it for a dollar a gallon. In 1899 Aldridge applied for a lease under part of Section 29, Township 1, Range 30, west of the 4th meridian, which was school lands held by the Dominion Government. No provision had been made for leasing mineral rights but he received assurance he could have the rights on proving he had oil in paying quantities, but rights were reserved pending proof.

John Lineham of Okotoks, and A.P. Patrick, a land surveyor, organized Rocky Mountain Development Company, and started drilling in 1902 near the seepage. At a depth of 1902 feet the well struck a flow of oil but the tools became stuck and the total production was reported as 8000 gallons of which 700 gallons was sold.

Numerous subsequent holes near the discovery have failed to find oil, which must have reached the Lineham well through fissures in the Precambrian sediments, here thrust over Cretaceous beds.

In 1890, R.G. McConnell of the Geological Survey of Canada, made a reconnaissance along



the Athabaska and Peace Rivers. He reported that the tar sands might be encountered at Athabaska Landing at a depth of 1200 to 1500 feet, and when encountered were likely to contain petroleum.

The Survey undertook to sink a bore hole at Athabaska Landing. Tenders were called and a contract awarded to A.W. Fraser. Machinery shipped from Toronto on July 14, 1894 reached Edmonton on July 26 and drilling started on August 15 -- an example of the fast service the C.P.R. gave in those days. Drilling continued into 1896 when abandonment at a depth of 1770 feet was necessary, as the driller had "run out of hole": that is, successively smaller diameters of casing had reduced the size until further progress was impossible.

A second well was started by the same contractor about 65 miles down the North Saskatchewan River from Edmonton near a locality known as Victoria Settlement, and I think it is now called Pakan Settlement. A rig with casing and supplies was brought up the river, reaching the site June 12, 1897 and drilling continued to the fall of 1899 when they "ran out of hole" at 1840 feet. The forecast at this point was to find the tar sand horizon at 2000 feet. The location was less than twenty miles from the Redwater field, but it is probably fortunate that it was not located on the field and that tools were unable to drill to 3200 feet, for the technique



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of cementing casing had not yet been developed, and a wild well would almost certainly have followed.

The first rig, used at Athabaska Landing, was moved to Pelican Rapids (indicating on map) where in 1897 it struck gas at 820 feet and the gas flowed uncontrolled for 21 years. Other wells in the vicinity followed over the next few years, most of them finding gas in the Pelican sand, now known to be correlative to the Viking sand. So far as we can learn, drilling subsequent to the government well at Pelican Rapids was done by private companies.

I will now touch on the Calgary Natural Gas Company. A.W. Dingman had some experience in Ontario in drilling and he promoted the Calgary Natural Gas Company, and a list of its shareholders was a fair census of business men on 8th Avenue in 1906, which was the year I first saw Calgary. A first well on the edge of Sarcee Indian Reserve was drilled in 1906 to 1908 to the depth of 3400 feet. This was a previously unmatched depth in the west, and we understand on abandonment he recovered every joint of pipe used, thus keeping his good name as a driller -- those days have now gone, by the way. No gas of enough consequence to use was found, and the rig was moved to East Calgary and a well was drilled on Col. Walker's estate. This well reached 3125 feet in September 1909, and obtained a modest flow of gas which was piped to the Calgary Brewery and some houses



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were supplied.

Somewhere about the same time as A.W.

Dingman's venture, a plant for manufacture of gas from coal was set up on 10th Avenue near 4th Street West, complete with a gas holder, and some 26 miles of distributing mains were laid, with connections for some 1800 customers.

In June 1910, Eugene Coste organized the Prairie Gas Fuel Company and carried on negotiations to amalgamate Calgary Natural Gas Company and Calgary Gas Company. He took over wells drilled by the C.P.R. at Bow Island, Brooks, Bassano and Dunmore and planned to drill more wells at Bow Island where prospects seemed best.

Then, in August 1911 Prairie Gas Fuel Company changed its name and what was probably the longest pipeline up to that time for delivery of gas was started. That, I understand, is the longest pipeline of its size, at least -- perhaps the longest, in any case -- that had ever been built anywhere for gas. More wells had been drilled at Bow Island, with apparently adequate deliverability to supply Calgary. In the fall of 1912 the line had been laid, 16 inches in diameter and 175 miles long, and gas was turned on. The writer was married in June 1912, rented a newly built house in East Calgary and was served with gas for a cook stove from the Walker well. Before winter came, the gas company put in a larger meter



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and connected the furnace with gas from Bow Island.

By 1920 the supply began to fail. The gas company began searching for additional supplies adjacent to the line and the search continued over some years. They found gas at Foremost and a 10-inch line was run to connect with the 16-inch line. I did not give a date, but I think it was 1923. A small supply was found at Barnwell, but at too low a pressure to be of much value.

The writer had been overseas and during the winters 1920 to 1924 had coal ready to fire in his furnace when gas pressure became low.

This brings me to the point where I think it would be advisable to make some comment on the appraisal of gas reserves, for the outlook on this subject has changed over the years.

The early wells at Medicine Hat and Bow Island and at Brooks (where gas had been found as early as 1910) were generally drilled with cable tools until the top of the sand was encountered, when casing was set down on bottom and a foot or two of sand drilled out. No cement was used to bind the casing to the rock, no very good sample of sand could ever be obtained -- certainly no cores taken, to be analyzed for porosity and permeability and the total thickness of sand was unknown. In fact about all that was known was the surface pressure of gas when the well was closed in, and the rate of flow of gas when the well was wide



open.

Present techniques call for obtaining a full core of the pay zone in at least a fairly large proportion of wells drilled. The producing string of casing has cement pumped down and followed by mud or water until all the cement rises outside the pipe, making escape of gas around the casing impossible. Perforations are then made in the casing to admit gas.

Cores cut during penetration of the gas horizon then tell the thickness of sand and in a laboratory the porosity and permeability are measured, the portion of pore space occupied by water can be arrived at, thus telling the effective size of pore space. As wells are drilled in a field, quite a good picture of the cubic contents of the reservoir can be obtained. Then knowing the pressure of gas within the reservoir, its supercompressibility, chemical composition, productivity index and expected loss on rejection of impurities and field fuel, the engineer can make assumptions as to the remaining pressure when deliverability becomes too low to make further production economic. Modern logging techniques fill in the gaps where no cores are available.

Note that when this first major pipeline was built from Bow Island to Calgary, almost none of the essential information was available. Initial open flow of wells and closed pressure were the sole criteria of the field, and had the promoters known all



the essential data about the field they would not have built the line.

I come now to Turner Valley. In 1911 the late W.S. Herron was living in Okotoks and carried on a hauling business. He hauled coal from a coal mine west of Turney Valley into town and near where he crossed Sheep River, he noticed gas bubbling through the water. Placing a barrel upside down over the seepage, he collected samples of the gas and sent them for analysis. The analysis showed presence of hydrocarbons heavier than methane. I did not enlarge on that in my paper, but that, to Mr. Herron, meant it indicated an oil field near. Mr. Herron then took up mineral rights in the vicinity and bought some 700 acres, undertaking to pay \$25 an acre. Realizing he must get more capital if he was to drill for oil, he interested some Calgary men, offering them 55% of the cost, which at that time had reached \$40,000 and they were to put up another \$50,000 in drilling for oil. Before he was through with negotiations, A.W. Dingman was brought into the company because of his knowledge of drilling, and Calgary Petroleum Products was formed.

Drilling started early in 1913 and by summer of 1914 at a depth of 1557 feet there was a flow of gas dripping with condensate that could be used as fuel in a motor car. By this time the outlook on value of gasoline had changed from the early demand for illuminants. The discovery touched off a boom, when



people lined up to buy shares. Grocers and wholesalers went short when people who ran monthly accounts failed to pay their bills and credit arrangements had to undergo revision, but a number of companies got enough money to enable them to drill.

Calgary Petroleum Products drilled three wells, all of them getting some gas and condensate, and an absorption plant was erected to strip the gas of its liquids. On October 20, 1920, fire destroyed the plant and need of replacement of the plant precipitated a reorganization with new capital. The new capital came from Imperial Oil through its subsidiary, Northwest Company, and Calgary Petroleum Products became Royalite Oil Company.

The new company started a fourth well. Gas from the absorption plant was piped to Okotoks to help supply Calgary, being turned into the line -- that is, the line from Bow Island to Calgary -- on December 31, 1921.

Royalite 4 found a flow of sweet gas at a depth of 2890 feet in September 1923, and it was turned into the line to help out Calgary supply for the winter. Drilling resumed in 1924 and on October 14, at a depth of 3740 feet, some 290 feet below the top of the Paleozoic limestone, the well blew in with a flow of 22 million cubic feet a day, dripping with condensate and loaded with sulphur. No casings had been cemented. When the valve was closed, pressure



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rose 100 pounds per minute and the crew retired to a distance. At the end of 15 minutes the last two casings rose to the top of the derrick. The valve was opened and the casings settled back about to position, but the well caught fire on November 9. By November 20 a battery of seven boilers succeeded in putting out the fire -- steam room. Concrete was poured around the casing in a big block, but the well was never closed in again to observe pressure.

Up to about the middle of 1929 the well produced with little sign of fluctuation save for somewhat better recovery of condensate (or naphtha) in winter and during its life yielded 925,810 barrels, much of it sold for four or five dollars a barrel -- none less than three dollars.

As soon as Royalite 4 was under control a scrubbing plant was erected to remove sulphur from the gas. Additional pipelines were laid to join the 16-inch line from Bow Island to Calgary, and Canadian Western was able to meet the demands of Calgary, Lethbridge and the towns along the line.

With such a gold mine as Royalite 4 to lead them on, drilling proceeded apace. But Royalite had a contract with the Gas Company and only wells owned or controlled by Royalite could get any return from the gas, and few of the wells yielded enough condensate to make them able to pay drilling costs, and there was a problem facing the industry to control



waste of gas, for operators continued to flow their wells, burning gas in flares after it passed the separators.

Royalite erected an absorption plant later, gathering gas from some of the wells and extracting much condensate that would not drop out in separators. A second Royalite absorption plant was built, as well as plants built by British American and Gas and Oil Products.

The Dominion Government was the owner of mineral rights that had not been alienated to the C.P.R., C. & E. and homesteads, and it made efforts to curb flaring of gas, but legal difficulties made its efforts of little avail. One scheme succeeded when the Gas Company proposed to store surplus gas in the depleted Bow Island field, and storage actually started on August 4, 1930.

Natural resources were transferred from the Dominion to the provinces as of September 30, 1930, and Alberta brought into force an Act to regulate oil and gas wells. It empowered the government to appoint advisory committees and on July 10, 1931, A.A. Carpenter, formerly a judge and then chairman of the Board of Public Utilities Commissioners, headed the committee. An expert, Frank P. Fisher, was brought in and a staff of engineers commenced tests of wells. Fisher managed to get a partial concurrence in a plan to control the situation and



submitted a report on October 6, 1931, admittedly as a basis for negotiation. The major operator (Imperial Oil) and over half the independents concurred and the exclusive contract for Royalite to supply gas to Calgary was within a hair's breadth of being relinquished. The legislature passed an Act to confirm the proceedings when suit was entered by one of the independent operators to declare the law ultra vires of the province. Alberta asked the Dominion to pass a law confirming the Alberta Act, but the Dominion shrugged off the request with the plea that the natural resources were in provincial hands.



On June 16, 1936, Turner Valley Royalties found oil on the west flank of the field with a modest flow of about two million cubic feet a day of gas, but carrying a mist of oil. In 199 days of 1936 it averaged 770 barrels a day. Every available truck was engaged in hauling it to refineries until a pipe line could be laid.

Following this discovery, the west flank of the field was drilled, with a number of long extensions recorded. Drilling was practically completed by 1948, with only a few wells drilled since then, and the field is gradually being exhausted. Some operators have, over the past several years, been working over some wells to improve production and a project for injection of water has increased the recovery of adjacent wells but the field is so broken up into minor reservoirs that any one water injection scheme is only locally effective.

For a time the gas produced with oil had to be flared at the same time that gas was needed from the gas cap. This led to construction of gathering lines for casinghead gas, carried out under supervision of the Natural Gas Utilities Commission, which also conducted public hearings, following which price of gas to producers was set, and credits established to the companies that had laid earlier gas collection systems.



I have omitted, intentionally, to go into the matter of the price of gas and I will answer some questions on that later, if it is so desired.

Well Spacing: It would be in order to recall that Turner Valley first brought about some appreciation of the need of well spacing orders.

An early well had its derrick built at the extreme edge of its lease. At that time it was thought a cable tool hole went vertically downward, but no doubt the operator hoped to drain oil from the adjacent lease. Subsequent data has shown that even a cable tool hole may wander materially from the vertical. A first move came by (Dominion) Order in Council of April 26, 1922, requiring that no well be drilled from a point less than 200 feet from its lease boundary. Under this order we would see a well located 200 feet from two boundaries, and immediately offset by three other wells to avoid drainage from other leases. We saw one 10-acre lease that had two wells actually drilled to the limestone and a third started. Neither completion had a chance of paying out. Another 40-acre lease had nine projected wells, three of which reached the limestone but were hopelessly small producers. Four other wells were started but abandoned before reaching a producing horizon. Some of the wells that reached the limestone in this particular parcel were found to have wandered off the lease. They



were drilled by rotary tools and at that time techniques of drilling vertical holes had not been perfected.

Some of these occurrences led to a requirement that a well must be located not less than 330 feet from the lease boundary. Eventually when allocation of allowable production became necessary, if more than one well was drilled on 40 acres, they were penalized as to allowed production.

Now the Conservation Board hears submissions from operators in a field as to well spacing and issues appropriate orders

Prorotation of Oil Production: Another item that was developed in Turner Valley was the prorotation of oil production.

Turner Valley flush production from wells on the west flank was so prolific that existing refiners had to limit purchases of crude oil. A purchaser's proration led to feelings that individual operators were being unduly restricted and purchasers felt they would be in a better position in relation to suppliers if an independent authority did the prorating. In other words, the refinery was the goat that everyone kicked against and the refinery thought it better for someone else to do the prorating. This precipitated formation of the Conservation Board about the middle of 1938, set up under the Alberta Government, and it allocated production to



each well.

Hon. N. E. Tanner, as Minister of Lands and Mines then was able to go to the Dominion Government and secure legislation confirming that Alberta was within its rights in limiting gas production from any well. This led to curbing the flaring of gas, but it came after an estimated trillion cubic feet of gas had been flared from Turner Valley.

Side Effects of the 1914 Boom: During the wild speculation spree of 1914, much money was raised for exploration. One of the companies was formed by Charles E. Taylor and it drilled a well close to Battle River, west of Fabyan, where Grattan Creek enters the river. Started in 1914, shortages of material in wartime led to its abandonment after some showings of gas and oil.

A second well was drilled near the first, starting in 1917 and it found gas and it is now known to be on the fringe of Kinsella gas field.

Meantime Charles Taylor realized that exploration for oil and gas is so costly that it needs big money to back it. He went to Imperial Oil, saw A. M. McQueen, then vice-president for production, and arranged for financing of exploration. A subsidiary was set up as The Northwest Company and in 1919 he was made manager. A separate geological department of Imperial was set up, headed by Dr. T. O. Bosworth. The two organizations were to work



together and during the season of 1919 some fourteen geological parties took to the field.

Not waiting for results of the geological surveys The Northwest Company started drilling wells from southern to central Saskatchewan, at a location near Czar, Alberta, in the foothills on Willow Creek, on Peace River near Pouce Coupe and down the Mackenzie at Norman Wells. Of all the many wells drilled over this wide area, Norman Wells was the only oil discovery and it had to wait many years before it achieved commercial use. A well at Pouce Coupe found gas but had to wait so long for market as to make it scarcely worth comment. However, the venture into Turner Valley, already mentioned, was of almost immediate value, and Charlie Taylor's nephew, Walker L. Taylor, headed up the new organization in its early years.

A venture by Northern Alberta Natural Gas Company was started in 1914 prior to the Turner Valley boom, and its first well found gas north of Viking. Nine other wells were drilled in the next few years and pipe was ordered to lay a line to serve Edmonton. With the pipe loaded on cars ready to ship, wartime increases in price of pipe and possibly fear that the additional fittings and distribution pipe might be difficult to get and costly, the pipe already loaded was sold at a profit, and Edmonton did not get gas until 1923. By this time the



original company was reorganized as Northwestern Utilities Limited, and both N.U.L. and C.W.N.G. came under related management. For some years cheap, low grade coal mined in and near the Edmonton city limits competed with gas as domestic fuel and in the lean 1930s when unemployment was high, gas had a difficult time in gaining domestic use.

The Viking field was apparently delineated by a dry hole to the east comprised about 25 square miles and some concern was felt as to its continued value as a supply for Edmonton. None of the wells had been cored and only two had been drilled deep enough to know the sane thickness.

Then in 1929 a wildcat was drilled by another company some 12 miles east of the known Viking field. It was completed in early 1930 with an unusually large open flow and was shut in for lack of an outlet. Two years later, N.U.L. drilled two widely spaced wells that indicated a large field.

Failure to find prolific oil fields led Imperial Oil to consider production of synthetic oil using gas as starting material, and that company in 1945 took up wide holdings in what appeared to include the gas field and during 1945 and 1946 drilled widely spaced wells to evaluate the reservoir. The discovery of Leduc in 1947 showed that synthetic oil was not needed and Imperial sold out its holdings to Northwestern Utilities.



In 1940 N.U.L. extended its gathering lines to the Insella portion of the field and in 1945 to 1947 extended distribution lines to serve Camrose, Wetaskiwin, Ponoka, Lacombe and Red Deer. Vegreville had previously been served.

We go back now to 1925 when a company using private capital found oil near Wainwright. It was of fairly low gravity, containing asphalt and wax, was low in gasoline content, but could turn out asphalt, distillate suitable for tractors and heavy fuel oil. Small refineries erected locally refined it, but all of them had marginal economic success. None of the wells yielded at prolific rates, and some dry holes discouraged rapid exploitation.

Some oil production started at Lloydminster in 1939 and Vermilion produced a little the same year. Lloydminster oil is somewhat heavier at Wainwright, and Vermilion heavier still. A little oil was found at Dina, but the pool was disappointingly small.

Standard Oil of California: A United States Company entered Alberta, under the name of Standard Oil California of British Columbia, and after a succession of names is now known as The California Standard Company. It found two oil pools near Taber, with first production actually found by another company in 1937, Plains Petroleum Corp. who drilled on a structure reported in 1935 by G.S.C.A. discovery near Princess in the Devonian



in 1940 was the earliest from so low a horizon, but a bit of a teaser. Some oil was produced there as early as 1939. A Jurassic discovery at Conrad came in 1944.

Red Coulee: A Calgary company sent a geologist, Dr. T. B. Williams, out into the blue in 1929 and he made a location close to the Montana border, finding oil in his first try. The field was limited to about 200 acres in Alberta but some 328,000 barrels of oil was produced from Alberta wells and it is believed some 700,000 barrels of oil came from wells in the field on the Montana side of the border.

Pendant d'Oreille: McColl Frontenac, a Canadian company affiliated with Texaco, and Union Oil Company of California, started exploration about 1943 in an area south and southeast of Foremost gas field and found the large Pendant d'Oreille gas field and several separate gas fields. As in the exploration by Imperial Oil in Kinsella field, these companies considered synthetic oil production, but when Leduc and subsequent discoveries made that impractical, they sold their holdings to Montana gas interests.

Jumping Pound: Shell Oil Company discovered this large gas field late in 1944 after an earlier well had been drilled off structure and abandoned at over 12,000 feet. The field is deep and hence costly to drill. The gas contains sulphur



which must be removed along with carbon dioxide and water vapor and liquefiable hydrocarbons before it can be piped to Calgary.

Miscellaneous Discoveries: Numerous scattered wells during the period under review found gas flows, but in absence of any prospect of market, the discoveries were plugged and abandoned and no fair appraisal of them can be made. Here I might say, there was a little oil discovered in what was called Dina just across the border, but it is so small it really escaped my attention when I wrote this.

In Saskatchewan, the Lloydminster field, extending across the border of Alberta, was the only oil discovery. Imperial Oil at one time took up large blanket holdings and drilled quite a number of holes without finding anything commercial, and in Manitoba exploration was almost non-existent.

Oil production from Lloydminster wells in Saskatchewan started in 1945, increasing only slowly until late in 1946 and reaching about 750 barrels daily toward the end of that year. I leave later production there for someone else to cover as this is only the geology I am touching on.

Gas was discovered just north of the town of Lloydminster in 1934 in a well drilled by Lloydminster Gas Company and pipe was laid to serve domestic consumers in the town. The sand was known



as Colony, and was known to be erratic in occurrence. The well played out inside three years but several wells south of town, drilled the following year, found gas and were connected to the system, and other gas wells in the same horizon have followed.



Near Unity, a gas field was discovered in 1944 and after obtaining several wells all in the Viking sand, a pipeline was laid to supply the town. Ironically, one of the wells drilled by The Northwest Company in 1920 was just off the edge of the field.

Kamsack has a number of very shallow wells producing from depths of 200 to 400 feet. The history of drilling is not very clear, but the earliest gas producer was drilled at least as early as 1943. The pressure is low (about 25 pounds per square inch), deliverability low (up to 250,000 cubic feet a day), reserves indefinite, but the gas is used locally and is useful while it lasts. A report in 1945 indicated that there were some 55 wells.

Manitoba: To the close of 1946 some scattered drilling had made no discoveries.

British Columbia: Rather scattered desultory drilling on the Pacific Coast, Queen Charlotte Islands and interior had produced no discoveries. The Flat-head area had a few false starts abandoned at rather shallow depth around 1913-14 and later, with an abandonment in 1919 at 3265 feet, another hole started in 1941 and not finished until 1949 at 3600 feet. Another hole was abandoned in 1938 at 7825 feet.

In northeast B.C. the provincial government drilled a well at Commotion Creek and Pine River confluence, suspending operations in 1942 at 6941 feet.



Northwest Territories: With construction of the Alaska Highway in 1943, some geological parties had access to a vast area and some field parties made surface studies. Some drilling followed but no completed discoveries have been recorded. That is up to the end of the time I am covering. We have earlier mentioned discovery of oil at Norman Wells in 1920.

A comment is worthy on stratigraphic exploration: although practically no oil or gas were found by a drilling program carried out by Imperial Oil during the years 1944 to 1946, that company drilled what we may call a cross section of the sediments from the vicinity of Lethbridge eastward into Saskatchewan, northward and again west. I am not including in that the earlier exploration that I have mentioned. Most of the wells penetrated the upper Paleozoic, some going well into the Devonian and some in Saskatchewan went to the basement or Precambrian rocks.

The Leduc discovery was thus paved by a thorough study of sediments in the stratigraphic column over a wide area. The study, by the way, was very expensive. We wish we could say that Leduc was expected, but it is our opinion from crumbs we can gather that the test was near a large river, needed for cooling water in a plant for producing synthetic oil, that the intention was to explore only the Mesozoic sediments, and was carried some 700 feet deeper owing to the wish to get stratigraphic



information.

Bituminous Sands: Up to the close of 1946 we can record numerous attempts to obtain economic recovery of hydrocarbons but no real success. Surveys over a period of a dozen years up to 1924 by S.C. Ells mapped the exposures, did some work on finding the amount of overburden and studied attempts in other parts of the world to separate oil from sand.

Over a period of years, R.C. Fitzsimmons attempted pilot plant operations at Bitumount, some 30 miles below McMurray and succeeded in making separation using hot water but only on a small scale.

Here I should have mentioned some of the work Dr. K.A. Clarke of the Alberta Scientific and Industrial Research Council who did a great deal of laboratory work with the tar sands and published several papers, and some of his staff have also published papers on the tar sands.

Max Ball started Abasand Oils Limited, built a plant near McMurray. The plant was burnt at the close of the season in 1941, and another one had to be built. During 1941 and 1942 the plant was subsidized by the Dominion Government. In 1941 some 20,000 barrels of oil was separated, put through a refinery in the plant, producing some gasoline and solvent used in the process and nearly 11,000 barrels of residuum, most of which was burned. Actually, so



far as we could learn, the total recovery went back into the process. Recoveries in 1942 were about half the quantities but essentially the same picture.

Over the years numerous other attacks have been tried, including application of heat at the bottom of a casing.

Some of the bituminous sand was shipped in its native state to Edmonton and to Jasper and used quite successfully in paving, although the material had to be removed from railway cars almost by mining methods.

Proposals for recovery subsequent to 1946 are omitted.

I would suggest that those who have copies should turn to the tables which follow.

Table I attempts to show only those fields which have produced or are expected to produce more than half a million barrels of oil; that is, in Western Canada, while Table III is limited to Alberta, and if a well produced some commercial oil, it was considered successful.

Table II, which is a table of gas reserves discovered prior to the end of 1946, attempts to show only those fields which have been developed sufficiently to warrant estimates of gas reserves of a size likely to be worth gathering, while Table III, again limited to Alberta, includes as successful those wells completed as oil producers or potential



gas producers.

We have doubtless omitted some gas fields where there has been local use of gas in small amount, and we lack reserves of gas in Lloydminster field, Alberta and Saskatchewan portion, and in Unity field, Saskatchewan; but believe the aggregate totals are not materially affected, although admittedly some discoveries now considered as mere prospects may eventually prove to have reserves worth gathering.

Table II has two columns, showing estimates by different authorities and made at different times. First quoted are estimates by DeGolyer and MacNaughton, made in 1951, of initial reserves. Some revisions have doubtless been made at a later date, and in general we have listed total proven, probable and possible gas in place. This means that their estimates covered as wide an area around each field as was then indicated by available subsurface data.

In a second column are present estimates by the Conservation Board of initial reserves of gas in place. Since reserve estimates are always elastic it is interesting to note a comparison of aggregate figures. In 1951 the first appraisal of gas at Beaverhill Lake looked on the discovery as only a prospect, while later drilling has made an estimate of reserves possible. Again, in 1951 Provost had received too little development to warrant the estimate now believed to be reasonable.



TABLE I
Oil Reserves in Western Canada in
fields discovered to the end of 1946

Year Discovered	Field	Initial Reserves in millions of barrels
1914	Turner Valley, shallow	9
1920	Norman Wells	60
1925	Turner Valley gas cap Included with other limestone wells.	
1925	Wainwright	18
1929	Red Coulee (1/3 in Alberta)	1
1935	Turner Valley limestone	119
1937	Taber	3
1939	Lloydminster (Alta. and Sask.)	48
1939	Vermilion	1
1940	Princess	1
1944	Conrad	2
		<hr/> 262 <hr/>



TABLE II

Initial Gas Reserves in Alberta in
fields discovered to end of 1946

Year Discovered	Field	Billions of cubic feet D. & M.	Cons. Bd.
1904	Medicine Hat	1,185	1,197
1908	Bow Island	25	21
1910	Brooks	35	33
1914	Viking-Kinsella	1,113	1,138
1921	Suffield	71	25
1923	Foremost	32	35
1924	Turner Valley gas cap	1,325?	1,410 ^b
1936	" " dissolved	266?	750 ^b
1940	Tilley	97	-
1940	Princess	518 ^a	211
1943	Athabaska	10	19
1943	Pendant d'Oreille	330	236
1944	Jumping Pound	853	776 ^b
1944	Black Butte	65	42
1945	Patricia, Duchess	19	17
1946	Brooks Northeast	13	12
1946	Beaverhill Lake	-	50
1946	Provost	239	500
	Total	6,196	6,472

a. Only about half this amount likely to be available for sale.

b. Pipeline gas will be smaller by 20% or more owing to condensate and/or impurities.



TABLE III

Wells Drilled in Alberta to end of 1946

Exploratory, finding

<u>Year</u>	<u>Oil</u>	<u>Gas-Cond.</u>	<u>Dry</u>	<u>Total</u>
1924 & before	1	23	98	122
1925	1	-	3	4
1926	-	1	7	8
1927	-	1	4	5
1928	1	2	10	12
1929	2	-	19	21
1930	1	-	28	29
1931	-	-	9	9
1932	-	1	5	6
1933	1	1	5	7
1934	1	-	2	3
1935	-	-	2	2
1936	1	-	7	8
1937	1	1	13	15
1938	-	1	11	12
1939	3	2	13	18
1940	1	2	20	23
1941	1	-	19	20
1942	3	1	39	43
1943	-	2	32	34
1944	4	2	50	56
1945	3	3	50	56
1946	3	5	46	54
Total	27	48	492	567



TABLE III (cont'd)

Wells Drilled in Alberta to end of 1946

Development, finding

Year	Oil	Gas-Cond.	Dry	Total All Wells
1924 & before	1	101	20	244
1925	-	5	-	9
1926	2	4	9	23
1927	1	8	4	18
1928	3	14	5	34
1929	3	23	12	59
1930	4	47	11	91
1931	4	25	7	45
1932	1	9	-	16
1933	1	5	2	15
1934	1	6	5	15
1935	-	6	2	10
1936	1	7	3	19
1937	25	3	5	48
1938	35	2	4	53
1939	35	-	2	55
1940	44	-	2	69
1941	49	11	6	86
1942	38	2	17	100
1943	59	14	12	119
1944	62	9	10	137
1945	44	13	17	130
1946	22	32	22	130
Total	435	346	177	1,525



This table is a rearrangement of work in Alberta and I am sorry I cannot cover the rest of Canada. The numbers of wells given are for the year in which they finished drilling and some wells were drilling over long periods and some exploratory wells proved to be long extensions of previously discovered fields, and I bring to your attention that in 1956, which is past the period I am covering, in the one year alone Alberta had 1856 wells, which is 325 more than had been drilled right up to the end of 1946, and 478 were exploratory, with but 92 finding oil and 80 finding gas and 306 dry holes.

In development drilling there were 1,255 oil wells, 54 gas wells, 5 service wells and 64 dry holes.

The change in degree of success is notable. Much can be credited to more thorough coverage by geophysical surveys and better knowledge of subsurface geological conditions.

Now, I will not read the bibliography which follows and I could add some pertinent references if the Commission wishes to have them, and I will let this go now and throw myself open to criticism.

MR. PATTERSON: Q. Thank you, Mr. Beach. I think we are particularly interested in those historical tables which you have put together for us.

Sir, as a general comment in regard to the brief, it would seem that much of the early work was



haphazard as to the methods used and I wonder would you like to comment or compare the exploration and previous production methods that were used, for example, in 1900, 1920 and in 1940, for us?

A. Well, the very early explorations, to a very large extent, were made where there were seepages at the surface. In other words, there was some indication at the surface either by a seepage of gas or a seepage of oil that there might be something underground. That was the case in Ontario, as I have shown; it was the case at Waterton, and by 1920 when the Northwest Company got busy, I have told you some geological surveys had been started, but they didn't wait for that, they just went out into the blue and, whether there was any surface indications or not, I don't know; I have no indication.

It was not until very close to 1930 that the first seismic survey was made in Alberta. I am not too sure of the exact date. There was a survey made down near High River, after which the Arco well was started, and that was another well that was very crooked, it wandered off so far, they found a little bit of sign of oil there and the driller told me that he thought if they had a vertical hole they might have found a field.

Of course, seismic surveys are quite common now. In fact, the major companies do not have much drilling in the wildcat size ordinarily



without seismic surveys, and they also depend on aerial photography to quite an extent and studies of the geology of wells that have been drilled, as well as surface geology. That study of stratigraphic information tells where one formation pinches out and perhaps another one comes in, things of that kind.

So the technical side of the industry has taken great advances and I would say that most of those are within the last fifteen years.

I am afraid I might get into deep water if I am too specific on this. Some of them tell me they had a survey of some kind prior to that or they had some other means.

The matter of logging wells has taken very rapid strides, though. It was about 1939, I think, that the first electric log was made in Alberta and that was a very poor attempt. It may have been as early as 1937 -- I can't recall exactly -- but the improvement in the type of logging has been phenomenal and we have learned a great deal from the various types of logs that have been developed.

Q. Sir, might we pass on to a consideration of a few matters that I would like to get a little amplification on. If you would turn to page 4 in the brief, you make mention there of the anticlinal theory.

A. Yes.



Q. Does that theory have a place in exploration today and would you comment on its place?

A. It certainly has a place yet, but in the years that have intervened we have found that ore is found not only on anticlines but what they call pinch-outs, where a sand rises, perhaps, in one direction and then eventually is replaced by shale, so there is no permeability, and the pinch-out becomes a place where you find oil or gas.

There are also commissions where you have a fault, for example, and sand or other porous materials permeate at a fault where one part of the rock has been moved in relation to another.

Q. Sir, on page 8 you refer to a case of a well that was drilled on the Colonel Walker estate in Calgary in 1909.

A. Yes.

Q. Do you have any information on the potential of that well?

A. I don't know that I could say, right off. It was not a very large flow, but it was to supply some fuel for the brewery and for a number of wells around there. I would think it produced 20,000 or 25,000 cubic feet a day, and that would probably be about its limit; but that would only be a guess.

Possibly someone with the gas company would have some better information because they took the



well over. The well has been abandoned.

Q. Do you know the approximate date of its abandonment?

A. Well, it is within the last five years but I would have to look that up.

Q. Turning to page 9, sir, in the second paragraph at page 9 you mention that by 1920 the supply began to fail, and that, of course, is the supply to Calgary. In that regard do you feel it significant that, without much advance warning, the gas supplies began to fail?

A. Well, if I might amplify that: there would be plenty of gas for cooking for Calgary and Lethbridge and the towns that are around there, but the minute you got some zero weather everyone turned on their furnaces, which had not been turned on in the summertime, and there was not gas enough to supply everyone adequately. I know I suffered with a cold that first winter in 1920 and 1921. I bought the house I am living in now, and I can place it, from that, fairly well.

Q. Sir, you explain that reserve appraisal methods were not as good then as they are today but, even so, with much larger reserves and larger potential future markets of today, in your opinion do you think a similar situation could occur with little or no advance warning?

A. I doubt it very much. Mind you,



any one of the fields is subject to limitations of deliverability, and the deliverability naturally falls as the pressure falls, so any system of gas collection and transmission has to look very carefully to deliverability, and that is something which has been quite well developed within the last few years, certainly since the first line from Bow Island to Calgary.

As to the reserves, I tried to show, on Table 2, while there may be differences in individual appraisals, if you put about a dozen fields or more into one basket, as it were, the appraisals approach each other very closely.

Q. Could you tell me the approximate mileage of that pipe line you mentioned at page 8 as being in 1911, the longest pipe line?

A. 1912. I said it was 175 miles. Actually, that depends on just where you measure from and to. Some other authorities said 170 miles, but I didn't bother to change the figure I had used.

Q. Thank you. Sir, on page 13 you make reference to the Bow Island field as a storage reservoir for surplus gas.

A. Yes.

Q. I am advised that that reservoir is still being used for peak load gas.

A. I understand that is true.



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Q. Do you know what other reservoirs in the general vicinity of Calgary might be used for that purpose?

A. That is the only one I know of that has been used. In order to store gas it is necessary to put in compressors, and they were put in at Bow Island, and they have been used for a number of years. For quite a while the gas was put in and none taken off, and it is very difficult, on a line that is somewhere around 175 miles long, which has a city like Lethbridge towards the far end, to be able to draw gas fairly close to the city. That is, you are able to supply Lethbridge when the gas that comes out of there would not go as far as Calgary.

I don't know of any others that are in use and, in general, I would think you would want a reservoir which had limited initial capacity. If you have too large a reservoir, it takes too long a time to get the gas in and out again.

Q. Could you give us a general idea of costs of storing surplus gas, say, as in such a place as Bow Island?

A. Well, I think that is something that should be left to the gas company, who have been quite intimate -- I haven't actually looked it up. I know the costs of transmission are very considerable but, to give you figures that the Commission could depend on, I think, really, those should come from the gas company.



Q. Sir, on page 14 you mentioned to us that there was an Act passed by the Legislature in Alberta, and an action was commenced by one of the independent operators to declare the law ultra vires of the Province. I wonder if you could expand on that, giving us a little more detail, and what the outcome of that action was?

A. I wish I could remember what it was but I am afraid that a long time has gone by the boards and I cannot, but I do know that Frank Fisher was a going concern who took a lot of pains to try to get the concurrence of operators. We had at the time a feeling among some of them such as: "That is my well. I put \$100,000 into that and you are not going to come in and tell me how to run my property", and with that attitude a bit of difficulty was experienced in getting any kind of concurrence and any proposal, but at all events Frank Fisher had the concurrence of the major operator, Imperial Oil -- Royalite, as it was then, or the Northwest Company -- and he had over half of the independent operators, or the owners of over half of the independently operated wells, and it got to the point that when the Oil and Gas Wells Act was passed by the Legislature and they were just about ready to enforce the control of gas that some independent operator brought that action. Now, whether that action was tried or not, I do not know; I cannot tell you, but perhaps



Mr. Frawley knows that and can tell you.

MR. FRAWLEY: I certainly can.

THE WITNESS: You can?

MR. FRAWLEY: Yes. It is all in the record and we can cite you the place in the Supreme Court of Canada where it was decided. The name of the company was Spooner Oil.

THE WITNESS: Thank you very much. I could not remember that.

MR. PATTERSON: Q. Sir, from your early association with the Conservation Board can you give us an idea of what or how the basis of making estimates of reserves compares with the basis used in those days, and would you also hazard a guess as to the range of probable error in those days, and perhaps by more modern methods?

A. Well, during the completing of Turner Valley there was not a well that had a full core of the pay horizon. There were a few cores, perhaps ten feet long, where they hoped to get the best pay, and some efforts were made along about 1939 to analyze those cores for porosity and permeability, but the equipment was not as good as we have now, and we did not get very far with it. Some of the geologists in examining under the microscope the drill cuttings from the wells put down, perhaps: "This sample has A porosity", and "This one has B porosity", and so on, and I guess at one time this geologist would



make a guess as to what he meant by A, B, C and D, and so on, and from that we made an estimate of the reservoir space in which the oil was found, but at best, it was a guess. As we came up with that we thought there were around some 100 million barrels, but we have passed that figure of 100 million barrels, and I think according to the tables we have 119 million barrels from Turner Valley, so the estimates which were made then were not accurate, and even now if we make an estimate it depends so much on items not under our control that it is rather hard to say. You can figure out how much oil there is in a reservoir, but how much you will get out, or what is the recovery factor, is debatable. That recovery factor is subject to such things as: How long can you afford to operate the well; What does it cost you to keep the well in operation; How much are you getting for the oil? Somewhere along the line you are going to find that it no longer pays, and the production is cut off at a point either before or after what we had used in our preliminary estimates, so those are rather elastic figures but they have improved very materially over the years.

MR. PATTERSON: Those are all the questions I have, thank you, Mr. Beach.

THE CHAIRMAN: Thank you very, very much, Mr. Beach, for a most instructive historical background to this problem, and we appreciate very much



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your coming and giving this information, and also the time you have spent in preparing it. We are very grateful. Thank you very much, sir.

We will now have a break of ten minutes.

---A short recess.

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Submission of
THE OIL AND GAS CONSERVATION BOARD
PROVINCE OF ALBERTA

APPEARANCES:

Mr. I.N. McKinnon	-- Chairman
Mr. D.P. Goodall, P.Eng.	-- Deputy Chairman
Dr. G.W. Govier, P.Eng.	-- Member
Mr. N.A. Macleod	-- Solicitor
Mr. Douglas R. Craig	-- Reservoir (Oil) Engineer
Mr. John R. Pow	-- Geologist
Mr. J. Stabback	-- Gas Engineer
Mr. A.F. Manyluk	-- Development Engineer
Mr. R.J. Cooper	-- Statistician

THE CHAIRMAN: May we now resume, Mr. Pattillo?

MR. PATTILLO: Mr. Chairman, we now propose to hear from the Oil and Gas Conservation Board of the Province of Alberta. It is my understanding that the submission of the Board will be presented by more than one, and Mr. McKinnon is the Chairman and he will present the opening part of the submission. He will be followed by Dr. Govier, who will be followed by Mr. Goodall. Because of the extreme importance of this document, and the great effort that has



been put into it by the members of the Board, and the staff in the preparation of it, and because I know of the significance that the industry will place on it, I am suggesting that the whole of this document be read into the record. There may be one or two parts that either the reader or you, Mr. Chairman, may suggest can be deleted in reading, but if that should be the case then I think it is important that it be taken as read.

I would like to call Mr. McKinnon to commence the presentation of the document.

MR. PARKINSON: Could I interrupt Mr. McKinnon, sir, and ask whether you want to make a statement about the publication of the material ---

THE CHAIRMAN: Not at this stage.

IAN NICHOLSON McKINNON, called.

MR. PATTILLO: Q. Mr. McKinnon, may I get on the record your Christian names?

A. Ian Nicholson.

Q. And you are Chairman of the Oil and Gas Conservation Board of the Province of Alberta?

A. Yes.

Q. And you have been for how many years?

A. Ten years.



MR. PATTILLO: Thank you very much, Mr. McKinnon.

THE WITNESS: Mr. Chairman and members of the Commission, it is my pleasure to present today a submission prepared by the members and staff of the Oil and Gas Conservation Board. I have with me my two colleagues, Mr. D.P. Goodall, Deputy Chairman of the Board, and Dr. G.W. Govier, and the following senior members of the staff in addition to the Board's counsel, Mr. N.A. Macleod, J.R. Pow, geologist; A.F. Manyluk, development engineer; D.R. Craig, oil reservoir engineer; J. Stabback, gas engineer, and R.J. Cooper, statistician.

We will endeavour to answer any questions that the Commission may wish to ask. In the submission you will find a statement of gas reserves, and I would like to go on record as stating that the figures shown do not represent the findings of the Board with respect to the two applications for export which we now have before us. The reserve figures shown on the statement have been prepared by the staff, and in the case of some fields where there has been no new development they represent previous findings of the Board. The Commission will appreciate that the Board has not had the benefit of examination and cross-examination of the witnesses who are to testify to the reserve estimates submitted by Westcoast Transmission Company Limited and



the Alberta and Southern Gas Company in connection with their applications for export permits.

The Commission, I am sure, will appreciate also that the Board did not have too much time in which to prepare this submission, and if the Commission wishes any further information in regard to any matter coming within the purview of the Board, we will be glad to furnish it.

The submission itself is designed to acquaint members of the Commission with the general functions and policies of our Board. Its functions relate primarily to the production side of the oil and gas industry, to the effective utilization of gas, and to the removal of gas from the Province. The Board is not concerned with the refining of oil and deals only incidentally with the transportation and removal from the Province of oil.

Statements of Oil and Gas Reserves and Trends in Growth of Reserves are included. Also, for the convenience of the Commission, the geology of Alberta and the Nature of Oil and Gas are discussed briefly.

MR. PATTERSON Q. Mr. McKinnon, if I might for a moment interrupt you, it would assist us if, before you commence to read, we properly file as an exhibit the submission, and I suggest that in view of the fact that the Board has been good enough to set out alphabetically the various appendices that



the lettering in the appendices be used to designate the sub-exhibits, and if we follow that procedure then we will need little interruption as the hearing goes along, and when an appendix is referred to in the reading as an appendix I think, without comment, it will be clear in this case that it will be Exhibit C-4-2-A-B-C, as the case may be. If I might take a moment, then, to just actually take copies of the documents, and do that there will be no confusion. I am, therefore, sir, filing the submission of The Oil and Gas Conservation Board as Exhibit C-4-2, and the appendices which are contained in these volumes as appendices A down to O will become Exhibits C-4-2-A to -O inclusive.

THE CHAIRMAN: Thank you.

---EXHIBIT NO. C-4-2: Submission of The Oil and Gas Conservation Board, Province of Alberta.

---EXHIBITS NOS. C-4-2-A to C-4-2-O: Appendices filed with submission of The Oil and Gas Conservation Board, Province of Alberta.

THE WITNESS: The first Oil and Gas Conservation Act was passed in Alberta in 1918 and provided for the setting up of a Conservation Board. The present Oil and Gas Conservation Board functions under, and is responsible for the administration of, the Oil and Gas Conservation Act. The basic conservation concepts are set forth in section 4 of the



of the Act which reads:

"4. The intent and purpose of this Act

"are (a) to effect the conservation of
"the oil and gas resources of the Pro-
"vince,

" (b) to prevent the waste of the oil
"and gas resources of the Province,

" (c) to secure the observance of safe
"and efficient practices in the locating,
"spacing, drilling, equipping, completing,
"reworking, testing, operating and abandon-
"ment of wells and in all operations for
"the production of oil and gas, and

" (d) to afford to each owner the oppor-
"tunity of obtaining his just and equitable
"share of the production of any pool."

The Act applies to all wells in the Pro-
vince whether they be on Crown or freehold lands.

The Board is constituted under the Act as
a body politic and corporate, and consists of three
members who are appointed for a term of five years
and thereafter during the pleasure of the Lieutenant
Governor in Council. Members of the Board are pro-
hibited from holding any interest whatsoever in
any oil or gas property or in any business connected
with the oil and gas industry.

The Board is given complete authority in
the matter of appointing staff and may retain the



services of any technical experts in an advisory capacity. The head office of the Board is in Calgary and there are a northern district office at Edmonton and nine regional offices located at Black Diamond, Devon, Medicine Hat, Redwater, Camrose, Stettler, Drayton Valley, Lloydminster and Red Deer. The present staff consists of some fifty-eight engineers, geologists, statisticians, and other professional persons and some one hundred and thirty-five non-professional. This includes the field staff that numbers some fifty and consists about half of engineers and half of technicians and clerks. The Board is financed by Government and by industry and freehold owners on an approximately fifty-fifty basis.

The powers of the Board and the scope of its conservation responsibilities are defined in the Oil and Gas Conservation Act. The Drilling and Production Regulations established by order of the Lieutenant Governor in Council and the General Regulations established by Board order, each under the authority of the Act, detail the ground rules concerning the spacing, drilling and operation of oil and gas wells and the measurement of oil and gas.



Related to its conservation functions are the responsibilities of the Board concerning the removal of gas from the Province. The policy of the Province and the duties of the Board in implementing it are defined in the Gas Resources Preservation Act, 1956. These are fully treated under a later heading.

The Acts and regulations which the Board administers have been amended and replaced from time to time as a result of knowledge gained. Alberta has had to pioneer oil and gas legislation in Canada but was fortunate in being able to make use of the vast experience gained over a long period of years in the United States. The development of conservation under such legislation is portrayed in An Historical Sketch of Oil and Gas Conservation in Alberta, Appendix 6.

Valuable assistance has been received from the oil and gas industry itself in drafting new legislation and regulations. The task of the Board has been made a lot easier by the splendid support it has received from the industry in its efforts to promote efficient operating practices and procedures and to regulate production in the interests of securing the optimum recovery of our oil and gas reserves.

MR. MCKINNON: Mr. Chairman, my colleague, Dr. Govier, will read Chapter 2.

MR. GOVIER: Mr. Chairman, this is marked Chapter 2 and is entitled "The Nature of Oil and Gas."



Crude oil is a liquid mixture of paraffinic and other hydrocarbons spanning a wide range of molecular weights and containing varying amounts of sulphur, nitrogen and other elements. It ranges in specific gravity (relative to water) from about 0.77 to nearly 1 (API gravity from 50 to nearly 10) and varies widely in volatility.

THE CHAIRMAN: Dr. Govier, may I ask you a question I ordinarily would not ask at this stage.

MR. GOVIER: Certainly.

THE CHAIRMAN: What do the initials API mean?

MR. GOVIER: That refers to specific gravity scale. The letters API refer to American Petroleum Institute and the abbreviation refers to the standard scale adopted by that institute.

THE CHAIRMAN: Thank you, sir.

MR. GOVIER: I might note the API numbers go down as specific gravities go up.

Natural gas is a gaseous mixture of normal paraffinic hydrocarbons, mainly methane, which often is contaminated with water vapor, nitrogen, carbon dioxide and hydrogen sulphide.

The nature of the underground occurrence of oil and gas and its effect upon conservation were discussed in a general paper presented before the Canadian Institute of Mining and Metallurgy in 1950. The following discussion is abstracted from this paper.



Although the oil and gas concentrations underground are referred to as pools, it should be understood that the oil and gas do not occur in underground lakes but in the pore spaces of porous permeable rock. While there is not even yet a clear understanding of the origin of oil and gas in the earth, underground concentrations of these fluids are found trapped in porous rocks by impermeable formation. The physical nature of the reservoir rock may vary over wide limits and from the finest grained sands to cavernous limestones, of which latter the Leduc D-3 reservoir rock is typical. The pore or non-rock space may vary from less than 5 per cent to over 25 per cent. Reservoir rocks may vary over even greater limits in respect to their ability to permit the migration or movement of oil or gas. Permeability, or ease with which flow is permitted, is analagous to electrical conductivity -- the ease with which electrical current can flow. Permeability usually is measured in millidarcies and the permeability of oil and gas reservoir rocks is found generally to vary from well under 50 to over 1,000 millidarcies.

Connate Water: While most underground rocks exhibiting porosity and permeability are filled with salt water, I might say unfortunately, an oil or gas reservoir contains oil or gas, as well as some water, in its pore spaces. The water which fills part of the void spaces is termed "connate" or



"interstitial" water. It is believed to be water which was not displaced by the petroleum at the time of its accumulation and entrapment in the originally water saturated reservoir. The connate water content may range from 5 per cent to 40 per cent or more of the void space and is important, not only because it represents a part of the void space which does not contain oil or gas, but also because of the role it plays during the productive life of the reservoir.

Natural Gas: Natural gas as produced from a well may be divided into two separate categories:

1. Dry Gas.

The term "dry gas" refers specifically to gas which, composed mainly of the low molecular weight gases, methane and ethane, has no economically recoverable liquid hydrocarbons such as propane, butane, and pentanes plus and is, usually, not associated in the reservoir with commercial quantities of crude oil. The specific gravity of dry gas, compared with air, varies from 0.55 to 0.70.

2. Wet Gas

Wet gas is defined as natural gas which contains an economically recoverable quantity of liquid hydrocarbons. The degree of liquid saturation varies greatly, from an almost dry gas exemplified by the Joarcam Viking gas cap to the very wet gas of the Windfall D-3 Reefal pool. Wet gas may further be classified as:



- (1) Gas cap gas -- this is found in the interstices of rock directly overlying crude oil accumulations, the gas may be in intimate contact with either a commercial or non-commercial deposit of crude oil.
- (2) Solution gas -- this is gas dissolved in the crude oil during its formation and accumulation and unavoidably produced coincidentally with the crude oil. Gas cap gas and solution gas are often referred to as "associated gases", -- since they are sound or are in contact with crude oil.
- (3) Gas condensate gas -- a wet gaseous phase produced from gas condensate reservoirs of the Jumping Pound and Pincher Creek found in Mississippian accumulation.

Crude Oils: Crude oil accumulates as an "undersaturated" or a "saturated" oil, both terms referring to the relative amount of gas dissolved in the oil. For those crudes in which the amount of gas dissolved is less than that physically possible for the reservoir's pressure and temperature, the crude is called undersaturated, in other words, it could contain more gas. The degree of undersaturation for crude oils varies from slightly below the maximum amount of gas that could be dissolved in the oil to a large amount of undersaturation. Alternately, a saturated crude has the



maximum amount of gas in solution. Saturated crude oils generally have gas caps of various sizes associated with the oil, ranging from a fraction to possibly 100 times the reservoir rock volume of the oil zone. An example of an undersaturated crude is that found in the Pembina Cardium reservoir, and of a saturated crude, is that of the Leduc-Woodbend D-3 reservoir.

Condensate: In deep reservoirs, particularly in the foothills and "disturbed belt" region of Alberta, a hydrocarbon mixture which really is neither gas nor liquid is frequently found. These mixtures are ones which, in the reservoir, exist as a single fluid phase at reservoir pressure and temperature, yet, on being produced through surface separation devices form a "wet gas" and an oily liquid or "condensate". The condensate is a white to slightly coloured high quality oil of 45 degrees to 70 degrees API, not unlike a mixture of gasoline and very light machine oil.

Contaminants: Natural gases, crude oils, and condensates contain carbon dioxide, nitrogen, hydrogen sulphide and various other contaminants. The term "sour" is applied to those hydrocarbons which possess hydrogen sulphide -- without it, the hydrocarbons are called "sweet". Most Viking reservoirs in Alberta are "sweet", most Mississippian and Devonian pools are "sour".



Bottom Water: Quite often the hydrocarbon fluids are underlaid in the reservoir by water, that is, the pore spaces below the accumulation of oil and gas are completely filled with water. In the event of the occurrence of a saturated crude with an associated gas cap, the fluids arrange themselves, by gravitational segregation over geological time, so that the gas overlies the oil with a transition "gas-oil" zone between them, and the oil overlies the "bottom water" with a transition "oil-water" zone between it and the water.

Reservoir Drive: Oil of itself has little inherent energy to cause it to flow either to the bore of the hole man may drill into it or up the pipe man may lead from the surface to the reservoir. True, oil under pressure has a certain amount of compressive energy which aids in its expulsion from the reservoir but this is seldom sufficient to cause the flow of more than a very small fraction of the oil from the reservoir. The movement of oil from surrounding parts of the reservoir to the well bore and (in the case of a "flowing" well) up the tubing, is caused mainly by a displacement process involving the expansion either of underlying water or of gas. There are three major mechanisms by which oil may be displaced and caused to move to the well bore. These "reservoir drives" as they are called, are the water drive, the solution gas drive, and the gas cap



drive.

Water Drive: In the event of a reservoir being underlaid by a sufficiently large body of water, the oil or gas may be displaced by the upward expansion of the underlying water. This, the so-called water drive, is ordinarily the most efficient displacement process. A water drive may be developed when, because of pressure release at the well bore, a vast body of compressed water expands and moves toward the region of pressure release, pushing oil in front of it. The water drive mechanism is aided by gravitational aggregation and is efficient only when the rate of advance of the water front is extremely slow. Since the advance of the water-oil or water-gas interface is caused by the pressure release attending production of oil or gas the rate of advance of the interface generally is proportional to the rate of production of oil or gas. It, therefore, follows that the water drive mechanism can only be efficient when the rate of production, which controls the rate of advance of the water front, is maintained at an efficient low value. Experience in the operation of water drive oil fields, coupled with laboratory tests and theory, tells us that under ideal conditions recoveries as high as some 80 per cent of the oil in the reservoir might be expected.



Solution Gas Drive: Regardless of the existence or otherwise of a large body of underlying water, if the crude oil contains gas in solution -- and particularly if the oil is saturated with gas -- a solution gas drive may develop. This type of driving action occurs whenever the reservoir pressure is lowered to the point where gas starts to break out of solution from the oil. In the case of saturated crudes even a slight lowering in pressure causes gas evolution, while in the case of under-saturated crudes a substantial pressure decline may be required. In the solution gas drive the displacement of the oil results from the expansion and flow of gas evolved from solution in the oil. This is analagous to the displacement of soda-water by the evolution and expansion of dissolved carbon dioxide gas when the cap of a bottle (and the confining pressure) is removed.

The solution gas drive is not an efficient displacement process. While the oil recovery under this type of drive varies considerably with the characteristics of the reservoir fluids and the reservoir rock, recoveries of the order of 10 per cent to 25 per cent of the oil in the ground are all that may be expected.

Gas Cap Drive: The third type of displacement process, the gas cap drive, is one generally considered as intermediate in efficiency



between the solution gas and the water drive. Here the displacement is accomplished with the aid of the downward, piston-like expansion of the overlying gas cap.

I might interject, Mr. Chairman, that the oil reservoir engineer for the Conservation Board did not particularly approve of that method of explanation, but I think, perhaps, it suffices for our present purposes.

This expansion occurs with production from the field and as the reservoir pressure declines. The gas cap mechanism, like the water drive, is a rate-sensitive process and high efficiencies result only when the rate of expansion of the gas cap and the downward movement of the gas-oil interface is kept low. Most important, however, is the preservation of the gas cap which provides the driving energy. This means the prohibition of production of gas cap gas until after the recoverable oil has been produced.

That is the end of the discussion of the nature of oil and gas, and I would like now to call on Mr. D. P. Goodall, the Deputy Chairman of the Board, who will read the following section on Geology.

THE CHAIRMAN: Thank you, sir.

MR. GOODALL: Mr. Chairman, this is Chapter III, Geology of Alberta.



General Description: It is estimated that 96 per cent of Alberta is underlaid by deposits of sedimentary rock. The sediments cover a complex of igneous basement rock and thicken from their outcrop areas in northeastern Alberta to thicknesses exceeding 14,000 feet along the western edge of the Alberta plains and to even greater thicknesses in the foothills where thrust faulting may cause the cyclic repetition of formations. The manner in which the total thickness of sediments increases is illustrated in Figure III-1.

I think I might refer to that Figure now, which is on the following page. This is a map of the Province of Alberta, showing the thicknesses of sediments by contour lines, as we call them -- isopachs. You will notice the zero isopach in the northeast corner of the province. Here the sediments wedge out and the surface rocks from there northeastward are the igneous rocks of the Precambrian Shield. The thickness of sediments are depicted on this map by lines where anywhere on a line the thickness is the same. So, you will notice that the thickness of the sediments over the Precambrian rocks increase toward the southwest to a thickness of 15,000 feet or greater.

Geologists have classified the sedimentary deposits of Alberta into groups, formations and members, the most wide-spread being the group



and the most restricted being the member. A group contains two or more formations, each of which may embody two or more less extensive members having some geological character in common. The names and relative positions of these geological units are illustrated in diagrammatic form by Figure III-2, entitled "Table of Formations - Alberta".

This table, which follows the map previously described, is one prepared by the Board's geological staff and has appeared in quite a few publications, particularly the Schedule of Wells, which is a record of wells drilled in the province. You will notice the first two columns in the table gives the geological age. The third column is a section through the province along the South Central Mountains and Foothills; the next column, Southern Plains, the next Central Plains and North-Central Mountains and Foothills, Northwest Plains and Northeast Plains. I might say most of the formation names given in the South-Central Mountains and Foothills, North-Central Mountains and Foothills, and a large part in the Northwest Plains are names given by geologists to these formations from outcrops of the rocks in the mountain ranges. The larger proportion of the formation names, or group names, in the Southern Plains, Central Plains and Northeast Plains -- well, probably not the Northeast Plains -- the Southern



Plains and Central Plains, are derived from well logs. They were named when the formations were penetrated by drilling and very often were named from examination of drill cuttings and cores.

You might also note in some places on the chart that formation names do not carry across the full width of the chart, although there are other formations with different names come in at relatively the same position. Very often these are actually of the same age and deposition, but were encountered in widely spaced parts of the province and were given names first when discovered. Later drilling in between shows that the formations actually carried through. This is particularly applicable to the Bow Island formation: it was named from the Bow Island sand which produced gas in the Bow Island field. The Viking sand is in relatively the same position in the geological column and it was named from the Viking gas field when it was discovered as of the productive variety. The same applies to Cadotte.

Nearly all formations thin or become non-existent in an eastward direction within the Province. This is caused by the fact that certain formations were deposited to greater thicknesses in the western part of Alberta and that some formations were truncated by erosional forces in an eastward direction at various times during the



geological history of the Province. The cross-section, Figure III-3, illustrates the effect of truncation.

If you will refer to the cross-section following the table of formations, you will note this section crosses from east to west through the central part of Saskatchewan and Alberta. The sediments wedge out to zero thickness and the Precambrian basement rocks are exposed in the vicinity of Lac la Longe in Saskatchewan. Going westward the sediments thicken until they reach their maximum thickness in the extreme western part of Alberta.



Beneath the plains of Alberta, covering an area of about 220,000 square miles, the formations dip gently in a southwestward direction except in the southeastern part of the Province where a positive geological feature accounts for regional dips in other directions. As a result of regional dip, the drilling depths required to evaluate a specific formation increase in a westward direction.

The rate of regional dip increases from only a few feet per mile in northeastern Alberta to nearly 100 feet per mile adjacent to the foothills. Localized structural anomalies may distort, over limited areas, the pattern of regional dip.

The narrow foothills and mountain belts, shown in Figure III-1, together occupy an area of approximately 25,000 square miles. They are underlaid by formations that have been folded and faulted by extreme compressive forces. This has resulted in a complexity of structural configurations.

Geological and Geographical Distribution of Known Oil and Gas Reserves.

A number of formations underlying Alberta contain reserves of oil and gas. The reserves have accumulated in economic quantities where suitable reservoir rock and geological traps occur. The names and position of these productive formations are indicated in Figure III-2.



To date, approximately 27 per cent of the recoverable oil reserves and 41 per cent of the disposable gas reserves of Alberta have been discovered within the conglomerate and sandstone reservoirs contained by formations of Cretaceous age. The remaining reserves have been found nearly entirely in the limestone and dolomite reservoirs of the underlying formations of Mississippian and Devonian age.

We might refer to the charts, Figure III-4, and you will notice the first column Cardium reserves, 21.2 per cent.

I might say this reserve is contained almost entirely in the Pembina field.

Viking reserves and Blairmore-Mannville reserves are relatively insignificant at the present time.

The Rundle reserves have been coming into importance. The oil reserves at Turner Valley belong to this column, also the Westward-Ho, the Elton reserves and others.

Nisku (D-2) is one of the producing zones in the Leduc field, and the largest reserve is the Leduc (D-3) and is the reef type deposit of Redwater, Leduc, and so on.

There has been a slight correction made on this chart. We found there was a slight revision in the Department's estimate of oil reserves



after the chart was compiled, and the Board will supply the Commission with a revised copy.

Referring to the next chart, III-5, we found there is also a correction here. The heading of this chart, "Geological Distribution of Virgin Disposable Gas Reserves found in Alberta prior to Dec. 31, 1957" should be "Remaining Disposable Gas Reserves as at Dec. 31, 1957."

This chart did not have added production to date. The Board is having another chart made up which will supplement this one that is in the submission.

The geographical distribution of the known oil and gas reserves within the main producing formations of the Province is illustrated by Figures III-6 to III-9, inclusive. It is evident that the boundaries outlining the reserve areas may approximate either the truncated edges of the productive formation, the areal extremity of suitable trap development within the formation, or the limits of the successfully explored portion of a formation that is potentially productive over a wider area.

I should emphasize that the outlined areas shown on the maps are not intended to outline the areas where the formation occurs. It merely outlines the area where productive oil and gas have been discovered.

It is expected that future exploration



will result in the discovery of additional large reserves both within and outside of the presently-delineated general reserve areas. Recent important gas discoveries in certain Mississippian and Devonian formations of the foothills and eastern mountains and oil discoveries in other Devonian formations underlying a part of northwestern Alberta are highly significant as they reveal the potentiality of formations and regions that, until recently, were not considered as highly prospective.

Geological Characteristics of the Oil and Gas Fields of Alberta.

Oil and gas have been localized by stratigraphic, structural and combined stratigraphic-structural traps within the productive formations of Alberta.

MR. PATTILLO: May I interrupt you, now that you are starting on this new heading. I see we have reached adjournment time and this might be a good place to stop, if it would be convenient to you and the Commission.

THE CHAIRMAN: Yes. It is half-past twelve, if that is convenient to you, Mr. Goodall.

THE WITNESS: Very good.

THE CHAIRMAN: We could break now and continue at 2.00 o'clock this afternoon.

---Whereupon proceedings adjourned, at 12.28 P.M., until 2.00 P.M.



---Upon resuming at 2.00 P.M.:

THE CHAIRMAN: Gentlemen, may we now resume our hearing. Before asking Mr. Goodall to resume his brief I wonder if we are not trying to punish ourselves too much by this very short luncheon interlude, and if it would suit counsel and others primarily interested in these hearings we can start them at 9.45 instead of at 10.00 o'clock in the morning, and break off at 12.15 instead of 12.30. I hope that suits everybody's convenience. The Commission and staff and counsel are quite prepared to do that and feel it would work out a little better than having the existing hour and a half for luncheon. We are finding it is too much of a rush, so starting tomorrow morning we will commence at 9.45, adjourn at 12.15, re-assemble at 2.00 o'clock and adjourn again at 4.30.

Mr. Goodall, would you proceed, sir?

THE WITNESS: Mr. Chairman, before I proceed I might refer again to Figure III-5 which I mentioned before the adjournment. You will recall that I stated that this chart does not take into account production to date. The new chart which we will be supplying you with will show that production, and it will give the virgin disposable gas reserves as indicated in the heading on this chart. It makes a considerable difference in the amount of



gas in some of these columns. In Medicine Hat, the first one, it is 6.5 per cent, and the virgin reserves are much greater than that. This reserve is confined entirely to one field, and that field has been on production since about the turn of the century, so there has been a lot of production from that field to add to that column.

The Viking column will also be increased when you add on the production, because it has produced a lot of gas in Alberta. Rundle of the Mississippian Edge will include Turner Valley and Jumping Pond which have produced a considerable quantity of gas, so that will increase also quite a bit.

Turning again to the text: Geological Characteristics of the Oil and Gas Fields of Alberta. Oil and gas have been localized by stratigraphic, structural and combined stratigraphic-structural traps within the productive formations of Alberta.

Stratigraphic Traps: Stratigraphic traps are caused by either a change from one type of rock to another or by a variation of porosity and permeability within the same type of rock. When the permeability and porosity of a reservoir formation is terminated in a suitable pattern by these changes, a trap is formed, capable of collecting hydrocarbons that have migrated into the area containing the trap.



The regional tilt of a formation may assist this type of trap in localizing an accumulation of oil or gas.

We have some types of cross-sections of various types of traps on the board (indicating displayed diagrams). Mr. Pow will point out the stratigraphic trap. It is not necessarily distorted, but it shapes itself because it is surrounded by impervious material. The Leduc D-3 type of trap, which Mr. Pow is pointing out now, is a reef.

The sizes and shapes of the stratigraphic traps underlying the plains of Alberta are varied. The Cardium reserves and many of the Viking reserves have been localized within wide-spread but thin blanket deposits of sandstone contained within a host rock of shale. Other Cretaceous reserves are contained by small sandstone lenses or by narrow and elongated deposits of sand. Mississippian oil reserves have accumulated in southwestern Alberta where a portion of a tilted reservoir formation was decapitated and the area later covered by a layer of impervious rock. Mound-shaped Devonian reefs of porous carbonate rock contain large reserves that are confined to the reefs by surrounding shale. Other Devonian reserves are trapped within a



development of porous dolomite contained by a regionally-tilted formation of impervious dolomite.

Structural Traps: Structural traps are caused by the folding, tilting, fracturing or faulting of sedimentary strata. To qualify as a structural trap, it is necessary that these factors alone account for the confinement of the hydrocarbons within the reservoir rock.

The type of trap at Nisku D-2 which overlies the Leduc D-3 reef is warped over the top of the reef due to differential compaction of the sediments underlying it. You will also notice that the cross-section of Turner Valley is a structural trap.

In the foothills and eastern mountains of Alberta, the Mississippian oil and gas reserves have been localized at great depths by structural traps produced by intense forces of compression and shearing. Beneath the plains of northwestern Alberta, large gas reserves have been discovered in Cretaceous reservoir formations that were distorted into dome structures by the crustal adjustments of the basement rock. Additional structural traps occur in the Devonian Nisku (D-2) formation where it has been locally warped into a dome structure by differential compaction within a lower formation and where its porosity and permeability are developed over the entire structure.

Combination Traps: Combined stratigraphic-



structural traps are caused by a combination of the factors that produce stratigraphic and structural traps. Included in this category are those traps that have accounted for hydrocarbons being localized over only a part of the structure, the remaining part being unproductive due to the absence of reservoir rock. The boundaries of such a pool are determined both by the configuration of the structure where it contacts the fluid interfaces and by the position of the reservoir "pinch-out".

Many examples of combined stratigraphic-structural traps occur beneath the plains of Alberta. The most common are the numerous Gething, Blairmore and Mannville pools that have accumulated within lenticular deposits of sand covering a part of a dome or plunging anticline, the latter being associated generally with underlying Paleozoic erosional remnants or reefs.

The facility with which an oil or gas field can be discovered depends upon its depth, areal extent, the type of trap, the geological complexity of the region in which it occurs and the general adaptability of geophysical techniques to its detection. For these reasons, those fields buried deeply in the complicated folds and thrust faults of the foothills are more difficult and expensive to discover than the relatively shallow and widespread traps occurring within the less complex



formations underlying the plains of the Province.

Chapter IV: Location, Spacing, Licensing and Drilling of Wells: The spacing and location of wells is regulated by the Drilling and Production Regulations. The normal oil well spacing unit between the Alberta-Saskatchewan boundary and the 5th Meridian is one legal subdivision. The normal oil well spacing unit west of the 5th Meridian is two legal subdivisions, being either the east half or west half of a quarter section. The normal gas well spacing unit throughout the Province is one section.

To obtain a production allowable based on the area of a spacing unit the well must be completed within its target area. In the case of a one-legal subdivision spacing unit, the target area is a central square area with a side dimension of between 330 feet and 660 feet, depending on the depth. In the case of a one-section spacing unit, one has the choice of target areas in each of the central legal subdivisions or in the centre of the section. In the case of other spacing units larger than a legal subdivision, the target area is in a specified legal subdivision.

If a well is completed outside its target area, the area upon which its production allowance is based will be an area less than that of the spacing unit and determined in accordance with the regulations or the spacing unit order.



The Board has issued orders creating spacing units other than normal spacing units in a number of fields and areas throughout the Province. The Board believes, with industry, that the trend toward wider spacing generally is sound, and most abnormal units are larger than those that would apply in the absence of a spacing unit order. Some spacing unit orders are applicable for a limited time, and some are not. The orders subject to a time limitation are useful during the earlier operations in a field to permit a more rapid and economical reservoir appraisal, on a spacing pattern that contains larger units and that will permit "in-fill" drilling later if fuller knowledge of the reservoir indicates that the variation from normal units is not justified. Orders providing for abnormal spacing units for unlimited times are made after sufficient knowledge of the reservoir has been gained to prove that adherence to the normal unit is unjustified in the light of drainage characteristics or the economics of field development.

Licensing of Wells: Sections 18 to 32 inclusive of the Oil and Gas Conservation Act relate to the licensing of wells. No well may be drilled without a licence issued by the Minister of Mines and Minerals of the Province and application for a well licence may be made only by a person or company entitled to the oil or gas. If a well



is to be drilled for production of oil or gas the applicant must be entitled, or represent a party who is entitled, to the producing rights in the spacing unit in which the well is to be drilled, or if the well is to be drilled for some other purpose then the applicant must have the right to drill such a well. Application for a well licence must be submitted to the Board for examination and forwarding to the Minister with the Board's recommendation.

The proposed well location must have been surveyed by a surveyor or competent engineer and plans of the survey, endorsed by the applicant and the surveyor, must be submitted with the application. The survey plan must show the proposed well site in relation to an established land survey monument and also to the boundaries of the spacing unit in which it lies. It must also show all rights of way, building, mines in the same legal subdivision and all bodies of water or other wells in the same spacing unit.

A well for oil or gas may not be drilled within 330 feet of any right of way or permanent building unless the Board considers such a condition is justified. Drilling in the proximity of a coal mine is permitted only after the Board and the Director of Mines are satisfied that reasonable precautions have been undertaken to protect both the mining and the oil or gas operations from



foreseeable harm.

Before a licence for an oil or gas well will be issued to an applicant he must have with the Provincial Treasurer a minimum cash deposit of \$2,500. If he is to be the licensee of two or more wells the amount of the deposit must be a minimum of \$3,500. This deposit is refundable only after the wells for which he is licensee have been abandoned to the satisfaction of the Board.

The deposit is required in order to ensure the proper maintenance and eventual abandonment of any and all wells for which the depositor is owner or licensee and, upon failure of an operator, may be used to defray the cost of having any such necessary work done by the Board.

A well licence may be cancelled by the Minister of Mines and Minerals for a contravention of the Act, the regulations, a Board order or a condition of the licence.

Licences may also be amended or suspended by the Minister upon recommendation of the Board.

Application for a well licence must be accompanied by a fee of \$25.00 payable to the Provincial Treasurer.

Permits to Operate Drilling Equipment:
The Act requires that a party conducting drilling or reconditioning operations of a well must hold a permit from the Board to operate drilling equipment.



These permits are issued by the Board for a period of one year and may be cancelled by the Board if, in its opinion, a permittee fails to comply with the provisions of the Act, regulations, or orders thereunder. A permit fee of \$25.00 is required.

CHAPTER V

FIELD INSPECTIONS

In order to keep in touch with the wide-spread oil and gas development in the Province, the Board has established mine field areas each containing one office for the personnel who carry out the field inspections within that area. Each field office is in charge of an engineer who may have a staff of from one to six assistants. The make-up of the field staff varies with the requirements of each area but the normal office is composed of the field engineer, one assistant engineer, two technicians and a stenographer or clerk. The field staff by frequent inspections of drilling rigs, wells and production equipment determines if operations are being carried out in compliance with the Board's requirements. The inspector will observe if operations are being carried out in a safe manner; if avoidable waste of reservoir energy or produced fluids is occurring at any well; if surface damage is being kept at a minimum; and if the equipment and installations are such as to



allow for proper well testing, the measurement of gas, oil and water, and the obtaining of samples. He will also check to see if measurements of oil, gas and water production are properly made and recorded.

All well abandonments are inspected to see that the well is effectively sealed in and that the land surface has been cleaned up and levelled. In addition to inspections, the field staff collects and processes a great amount of information on drilling and completion of wells, pressure and temperature data, and other pertinent information, which is forwarded to the main office in Calgary for further studies.

Testing of Wells: Certain basic information is required by the Board on all wells drilled in the Province. This information is obtained by various tests and the taking of samples during the drilling and producing life of the wells. The information thus obtained is utilized by both the Board and industry in their study of oil and gas reservoirs. Without this storehouse of information both the Board and industry would be under a great handicap in any attempt to institute proper conservation measures.

Among other things the Board requires that,

- (a) rock cuttings and cores as specified by the Board Geologist be taken on



- (b) electric logs or other suitable logs be run on every well drilled;
- (c) tests at 500-foot intervals be run on all wells being drilled to determine the amount the hole deviates from vertical;
- (d) fluid samples from drill stem test recoveries on wildcat wells be taken and either submitted to the Board for analyses or analysed and a copy of the analyses submitted to the Board;
- (e) all gas wells be adequately tested by the back pressure method either before or shortly after going on steady production. (In the case where a gas producer is located in a field in which allowables are determined for each well, annual tests are required.)

Where a group of oil wells are operated as a battery and the individual wells are not produced into separate storage facilities and the produced fluids are commingled before measurement, which is the usual case, each well must be separately tested at regular intervals, usually once or twice a month.

For every new oil pool discovery a reservoir pressure is measured either by the company or with Board equipment. Reservoir pressure surveys are usually continued at least annually



on important discoveries. The Board maintains its own units for the measurement of such pressures, but generally confines its measurements to a check basis.

A representative sample of oil, gas and water, where available, is obtained from every oil or gas pool and analysed by the Board Chemist. This program is conducted by Board personnel to ensure standard sampling and analyses.

Many companies do much more testing and analysing than the Board requires, such as running productivity index tests, taking and analysing bottom hole samples, running additional types of logs, and the like. Copies of all such additional information are made available to the Board.

CHAPTER VI

LABORATORY SERVICES

The Board maintains a chemical laboratory in Edmonton for the purpose of analysing samples of oil, gas and water.

Crude oil samples are analysed by the U. S. Bureau of Mines method and the analyses may include the identification of fifteen fractions as to their specific gravity, aniline point, pour point, viscosity, and refractive index.

The laboratory has available a Hyd-Robot Podbielniak-low temperature distillation unit and



a new Burrel model K2 unit using the chromatographic method for the analysis of gas samples. An analysis for helium is also generally made on gas samples.

Water samples are analysed using gravimetric methods throughout including special analysis for bromide and iodide. Bacterial counts are not run.

In general, the Board runs very complete and thorough analyses on representative samples from the producing zone of a designated field, and only minimum analyses for purposes of identification on samples submitted from wells not in a designated field.

Reports of analyses on oil, gas or water samples from a well within a designated field are available to the public immediately, whereas the reports on samples taken from wells outside of a designated field are not made public until one year after the well has been completed or abandoned.

A sample laboratory for the processing and preservation of drill cuttings is maintained in the Board's Calgary office. Companies are required to take cuttings, as specified by the Board Geologist, and ship them to this laboratory; the cuttings, of course, are drill cuttings; bit samples. When received, the samples are machine washed, packaged and labelled in glass vials. To



date, the Board has washed and packaged sample cuttings representing about fifteen million feet of drilling. These sample cuttings may be examined by industry geologists to enable the preparation of geological maps and cross-sections used to facilitate the search for oil and gas.

Cores are selectively preserved by the Board when it is not the intention of an operator to provide such storage. The cores are available to the industry for examination.

At the present time the Board utilizes about 8,600 square feet of floor space for core storage and has an additional 4,350 square feet available for future use.



MR. GOODALL: Mr. Chairman, Dr. Govier will continue with Chapter VII.

THE CHAIRMAN: Thank you very much, Mr. Goodall.

DR. GOVIER: Mr. Chairman, this is Chapter VII on the Regulation and Disposition of Oil Production.

The Board regulates the rate of production of all crude oil wells in Alberta and seeks to do so on the basis of sound engineering and economic practices and with the intent of preventing waste, conserving oil resources, and maintaining equity.

Waste of oil occurs, in the obvious sense, if it is destroyed through burning or evaporation, or is permitted to seep into or flow over the land. Waste of this type is forbidden by regulations under the Oil and Gas Conservation Act, and proper control, containment, and storage of crude oil is required at all times. Underground waste occurs if recoverable oil is permitted to migrate to another formation from which it cannot be recovered. The Board, with its powers to regulate drilling, completing and abandoning of wells, requires that all fluids in underground strata be confined to their source horizons.

The least obvious but most significant form of waste occurs when economically recoverable oil is left in an underground pool through improper



production practices. Producing oil in such a manner that portions of the underground rock are by-passed by encroaching water or gas, and squandering reservoir energy through inefficient production rates are examples of production practices which cause reservoir losses and hence underground waste. The Board seeks to minimize underground waste of this type by setting a maximum rate of production for each oil well and each oil pool in the Province.

I would like to interject at this point that, as was mentioned in the introduction given by the Chairman, industry is well aware of the danger of underground waste and co-operates fully with the Board in efforts to minimize it.

Maximum Permissible Rates: It is well recognized in the oil industry that after sufficient production experience is gained from an oil pool it is possible to establish for the wells in the pool a "Maximum Efficient Rate" (MER) of oil production. The MER of a well or pool is that maximum rate at which production may be taken consistent with sound economics and good reservoir engineering practice. Unfortunately, the necessary experience and data to determine this rate properly are not available early in the life of a pool and recourse must be made to other methods.

Prior to 1950 maximum producing rates in Alberta were established by the Board upon the



recommendation of the various pool operators, and on a general judgment basis. During 1950 the Board adopted the concept of a "Maximum Permissible Rate" (MPR) of oil production. The MPR formula was developed by the Board to enable it to set allowables for wells on an equitable basis and on sound engineering grounds early in the life of a pool. Details of the formula may be found in Appendix E. The MPR of wells in a pool is based on the estimated recoverable reserves of the pool and takes into account the maximum rate at which the average well may be produced without either damage to the pool or waste of reservoir energy.

The MPR makes provision for variations in size of spacing units, and for variations in the mechanical producing efficiency of wells in a pool, penalizing those wells and pools where pressure differentials exist or where the production of excessive amounts of gas or water with each barrel of oil indicates poor utilization of reservoir energy.

With certain minor modifications, the Board's MPR formula has been the basis for establishing maximum rates of production for all new oil pools, and many older pools, since its first use in 1950. When there has been sufficient production history to fully determine the characteristics and recovery mechanism of a reservoir, it is the policy of the Board to supplant the MPR with the MER



previously referred to, which is based on extensive studies of well behaviour and reservoir engineering mechanics. MER's have been established for some seventeen pools in Alberta, representing just over one-half of the recoverable reserves of the Province. The MPR's and MER's of all pools are reviewed by the Board at least once a year at a public hearing.

Economic Allowance

It is recognized by the Board that certain types of marginal and sub-marginal wells cannot always be produced at that rate which will give the optimum physical recovery of oil, since production at such rates may be uneconomic. The Board, therefore, has established an economic allowance related to drilling and producing costs and scaled to depth. This allowance serves as a floor in the MPR calculation. A well is permitted to produce its economic allowance, subject to production penalties if excessive amounts of gas or water are produced along with the oil, even though some loss in reservoir efficiency may result. The Board's economic allowance scale has recently been reviewed at a public hearing and an amended scale, which is given in Appendix F, reflecting current costs and crude oil prices became effective on January 1st, 1958.

Market Proration

In 1949 the market demand for Alberta



crude oil fell below the level of production obtainable under the maximum producing rates then established. There followed several months during which production from various producing pools was prorated to the existing market on the basis of pipe line acceptances. Early in 1950, a number of producers requested that the Board establish an equitable system of proration to market demand.

The next sentence, Mr. Chairman, needs some correction, and I will read it as it should appear: A series of public hearings were held to consider the matter. The Board, having regard to the several systems recommended, established its plan for proration to market demand, which is given in Appendix F. This plan was put into effect in December, 1950, and with various modifications, has remained in use since that time.

Each month the Board holds a public hearing at which the crude oil purchasers' nominations for their requirements for the succeeding month, are presented. The Board, on the basis of the nominations and any evidence adduced then determines the provincial allowable for the month. The provincial allowance is then allocated among the pools and wells in the Province; firstly, on the basis of providing an economic allowance for each producing well and, secondly, on the basis of sharing the residual demand (after provision for the economic allow-



ance) in proportion to the pool or well MPR. or MER.

As a result of public hearings held in May, 1957, on the subject of the proration plan, the Board has announced that a revised method of proration will become effective in Alberta on January 1st, 1960. After providing for an economic allowance for each well in the Province, the revised plan provides for the sharing of the remaining demand on the basis of MPR minus the economic allowance. The effect of this revised plan is that well allowables will more closely approach constant percentages of their MPR's than under the current plan.

I might just illustrate with a few numbers the present and future proration plan. Suppose we assume a well which has an MPR of 100 barrels a day, and which has been assigned an economic allowance of 40 barrels a day: under the present proration plan that well would be entitled to its economic allowance, that is, 40 barrels a day out of the available market, and all other wells in the Province accordingly would be entitled to their economic allowances. Whatever amount of market remained after satisfying all the economic allowances would then be prorated amongst the wells in proportion to the MPR, and in the case of the sample well I have referred to, in proportion to its MPR of



60 as compared to the total of all MPR's in the Province ---

MR. PATTILLO: Is that 60 or 100?

DR. GOVIER: I beg your pardon: In proportion to its MPR of 100 as compared with the total of all MPR's in the Province. The new plan which will take effect on January 1st, 1960, if applied to the same well, would operate as follows: the well again would be entitled to its 40 barrels of economic allowance, as would all other wells in the Province be entitled to their economic allowances. The remaining market demand, after all economic allowances are satisfied, would then be prorated amongst all wells in the Province in proportion to the difference between their MPR's and their economic allowances -- in this case the difference between 100 and 40, or, in proportion to 60 as a residual MPR.

This matter is discussed more fully in one of the appendices, and if the Commission wished more details we can go into it at a later time, Mr. Chairman.

THE CHAIRMAN: Thank you.

DR. GOVIER: I will continue on page 31.
Disposition of Oil: In the complex flow pattern of crude oil from its source beds in the reservoir rock, through the well bore and flow lines to the field storage tanks, thence by pipe line networks



to processing and refining centres, and finally to market as a myriad of products, the Board's basic responsibilities terminate at the field storage point. Here safe containment in covered tanks is required, as well as the proper measurement of the oil and the filing of reports thereon.

The Board's responsibilities in the marketing and disposition of crude are discharged when the monthly purchasers' nominations have been translated into the provincial allowance and this allowance has been allocated by Board order between and among the pools and wells within the Province. On the question of regional market supply, the Board takes the position that its monthly proration orders will provide sufficient oil to meet the prevailing demand and that it is the responsibility of the crude oil producers and purchasers to make the necessary arrangements for movement of the crude to the various marketing areas.

Notwithstanding the above restrictions in the Board's responsibilities related to the disposition of oil, the Board and its statistics staff have attempted to keep themselves informed on the Canadian supply position. Each year the Statistics Department prepares for the internal use of the Board an Annual Review of the Oil and Gas Industry with special reference to Alberta. The Review for 1956 is attached as Appendix G. It contains some



figures and charts which may be of interest to the Commission. For example, it shows that the Canadian reserves of oil in 1956 were some 18 times the Canadian production and some 11.6 times the Canadian demand for crude oil and products. Both the production and demand figures refer to the calendar year 1956. This compares with United States figures of 11.9 times production and 11.3 times demand. The Board will be glad to furnish copies of the 1957 Review as soon as it is prepared.



I will continue with Chapter VIII,
Regulation of Production and Disposition of Gas.

Board Policy: In the case of gas the general policy with respect to production and conservation remains unchanged from that outlined in a submission by this Board before the Dinning Commission in 1949. This policy is summarized for the different categories of gas by the following excerpts from the submission.

1. Dry Gas

Complete prevention of production of gas beyond the amount which may be effectively utilized or stored - i.e. complete elimination of waste. Effective utilization may include use as fuel, as chemical raw material, etc. and also use to increase or facilitate the recovery of liquid petroleum in adjacent fields. It is the Board's policy to prevent the operation of any well in a manner which may cause damage to the reservoir resulting in a permanent loss of recoverable gas. This is satisfied by good engineering practice, by common sense operation and by avoiding excessive withdrawal rates.

2. (1) Wet Gas not Associated in the Reservoir with Commercial Quantities of Oil

The policy with respect to gas of this type is to permit production as in the case



of dry gas fields but to require the recovery of the economically recoverable liquid hydrocarbons before disposition of the gas.

(2) Wet Gas Associated in the Reservoir with Commercial Quantities of Oil

(a) Solution Gas

(1) The prevention of "excessive wastage" of gas. Ideally, the Board would prefer no waste of gas but it recognizes

A. that produced solution gas aids the lifting of oil from the reservoir and in this sense has undergone some "use";

B. that up to a certain volume and/or pressure it may be uneconomical to gather gas which is unavoidably produced with oil. This is usually the case early in the life of a field when its productive limits and potential productive capacity are unknown.

For these reasons the Board tolerates a "reasonable waste" of solution gas when such waste accompanies the economic production of liquid petroleum but not beyond the point where gathering of the gas is reasonably economical.



(ii) For such solution gas as can be economically gathered, the policy is to require the removal of the economically recoverable liquid hydrocarbons. The value of recoverable liquid hydrocarbons is usually a major factor in determining the volume and/or pressure at which solution gas can be economically gathered and processed.

(iii) The solution gas after removal of recoverable liquid hydrocarbons is termed residue gas.

I might say in properties at this stage it is closely analagous to a dry and a sweet gas.

The policy of the Board is to require complete effective use or storage of this gas. While effective use includes use as fuel, chemical raw material, etc., the Board is particularly concerned in seeing that, when economical and feasible from an engineering viewpoint, part or all of this residue gas be employed to increase the ultimate recovery of liquid petroleum from the reservoir.

I now come to the second category of wet gas,

(b) Gas Cap Gas

Production of gas of this type need not necessarily accompany the production



of liquid petroleum. The general policy of the Board is:

(i) to prevent production of gas cap gas for market so long as this gas, in the reservoir, is economically aiding in the recovery of the liquid petroleum underlying it;

(ii) to permit production of gas cap gas for the removal of liquid hydrocarbons so long as the residue gas obtained is returned to the reservoir and so long as the well is not operated in a manner which may cause damage to the reservoir resulting in a permanent loss of either recoverable oil or gas. The requirement of returning gas cap residue gas to the reservoir would be Board policy so long as this gas could economically aid in the recovery of the underlying liquid petroleum.

Mr. Chairman, the Turner Valley field presents rather a special case, and the paragraph I will now read deals with it as a special case.

Present practice in Turner Valley is to permit production of gas cap gas in accordance with the Brown plan and for removal of liquid hydrocarbons and effective use of the residue gas. This plan,



inaugurated several years after production from gas cap wells has started, represents a compromise between true conservation and unrestricted flow from the gas cap. Such a compromise is required because most of the gas cap wells were drilled and production was started before the engineering concepts of conservation were well developed. Furthermore, many of the Turner Valley wells which are drilled into the gas cap cannot reach the underlying oil which, because of the dip of the structure, underlies other leases. In such cases the practice of complete conservation is virtually impossible unless the entire field is operated as a unit. The present policy of the Board towards gas cap production from Turner Valley or from future similar fields

is to promote and assist efforts which would lead either formally or informally to the unit operation of the field and then to follow the general "gas cap" policy outlined above.

We come now to the third category of gas.

(3) Gas Condensate Gas

The present policy of the Board with respect to gas condensate gas is:

- (a) to prohibit the production of reservoir fluid pending detailed analyses of samples



of the reservoir fluid and determination of the engineering and economic importance of maintaining reservoir pressure;

- (b) if analyses and study should show no danger of retrograde condensation or no serious economic loss attending retrograde condensation, the policy of the Board would be to treat the fields as (1) "wet gas fields not associated with liquid petroleum", and to permit production for recovery of liquid hydrocarbons and effective utilization of the residue gas;
- (c) if analyses and study should show danger of retrograde condensation and serious economic loss of recoverable liquid hydrocarbons attending pressure decline below some critical value, the policy of the Board would be to permit the production of reservoir fluid for recovery of liquid hydrocarbons, but (if feasible from the engineering and economic viewpoint) to require the reinjection of the residue gas into the field for the purpose of pressure maintenance. This method of operation is often called



"cycling" or recycling" but is essentially pressure maintenance.

The effect of this policy would be, as in the case of gas cap gas, to defer the time when the residue gas from the gas-condensate fields would be available for market.

Gas Allowables (Non Associated Gas):

Alberta producers have been advised by the Board that gas production allowables would only be set for wells in pools or fields where reservoir conditions or equity considerations made it necessary. The presence of underlying water may require restriction in maximum daily rate of production to prevent water coning and thus premature abandonment of a well. Continued unequal withdrawals from wells on adjoining tracts having the same reserves could result in migration and loss of reserves by an owner.

I would like to read that sentence again, making a correction in it: Continued unequal withdrawals from wells on adjoining tracts tapping the same reserves could result in migration and loss of reserves by an owner.

To minimize these occurrences the Board has designed a Maximum Daily Allowable (Q_M), based on the deliverability characteristics



of the well and an Annual or Daily Average Allowable (MPRG) -- standing for "gas" -- based on the reserves of gas underlying the well's spacing unit. The details of the allowable calculations are contained in Board circular letters dated September 29th, 1954, May 31st, 1955 and December 13th, 1956. These letters are attached as Appendix "H". To date, allowables have been set in two gas fields -- Medicine Hat and Fort Saskatchewan. The data used in calculating allowables for these fields are obtained from the operators and other interested parties at annually scheduled hearings.

Gas Allowables (Associated Gas): Gas produced unavoidably with oil is restricted by the gas-oil ratio penalties governing oil production. For pools having a thin oil column underlying a gas cap and whose wells become severely penalized due to high producing gas-oil ratios, the Board has designed the Combination "Gas-Oil" Allowable scheme. This is a scheme whereby, provided all produced gas is conserved, an operator may produce one half of an economic oil allowance and all gas associated with it. Details of the scheme are outlined in Board circular letter dated November 2nd, 1955. That is also included in Appendix "H".

There are three or four pools producing under this allowable scheme at present and it is expected that the scheme will play a large part in the future



development of some fields for which there presently is no gas market, and therefore, cannot qualify for the allowable.

Gas Conservation: The conservation of gas produced unavoidably with oil is one of the most difficult problems the Board has to contend with. The Board realizes that early in the producing life of an oil field that a certain amount of gas wastage must be tolerated. However, it believes that when a field has been reasonably delineated and a reasonably accurate forecast of gas production can be made that the gas should be gathered, processed and marketed or stored if it can be established that this may be done without the producers being "out-of-pocket". The definition of "out-of-pocket" is, of course, a bone of some contention between industry and the Board.

The Board thinks that gas should be conserved if the cost of the project can be repaid over the producing life of a field and yield a utility rate of return on the investment even though this means that a producer may get nothing for the gas.



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There are, of course, many intangibles to be considered, particularly in estimating the revenues from a conservation project. It is difficult to forecast accurately the annual production of gas as this is tied to oil production which varies according to market demand and the provincial potential production. Future prices for natural gasoline, Liquifiable Petroleum Gases -- or, LPG's -- the by-products of processing, and residue gas also are difficult to gauge. While the market for these products is depressed at the present time, the Board believes an optimistic view should be taken on a long term basis.

With respect to all gas processing plants it is most important to consider the matter of the plant operating load factor. Plant capital and operating costs are high and it is essential to operate the plant at as high a load factor as possible to reduce unit operating costs.

When the Board considers that steps should be taken to conserve gas, it notifies the operators concerned and invites them to attend a meeting at which the Board's production forecasts and economic studies and those of the operators are thoroughly discussed. The operators may agree to construct the necessary facilities, but if this is not the case and the Board firmly believes the gas should be conserved, it issues an order requiring



that the gas produced with oil be conserved by a certain date and failure to comply means the shutting down of the wells.

Any plans for the gathering and processing of gas, including the specifications of any processing plant, must be approved by the Board under section 38 of the Oil and Gas Conservation Act. The Board usually holds a public hearing to consider the project. The approval may contain terms and conditions with respect to the percentage of produced gas to be gathered and processed, the percentage recovery of by-products required and facilities required for storage or other disposition of the products.

Chapter IX, Secondary Recovery: There is no known economic process by which all of the oil in porous rock may be recovered. Five groups of factors determine the fraction of the initial oil in place which may be obtained:

1. Reservoir rock properties, e.g. porosity, permeability, structural position and thickness;
2. Reservoir fluid properties, e.g. viscosity, pressure, gas saturation, phase and component distribution;
3. Drive mechanism, e.g. solution gas, gas cap or gravity drainage, water drive;
4. Method of production - well completion



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techniques, spacing of wells, rate of withdrawal;

5. Economic factors - drilling and completion costs, production costs, taxes, price of oil.

The degree of recovery realized from an oil or gas accumulation depends on the extent to which knowledge of these factors, and of their interdependence, is intelligently utilized. Further, the more accurately the factors comprising each group are known, the greater is the likelihood that optimum methods will be used to obtain maximum recovery. The importance of obtaining accurate data in all phases of oil exploration and development cannot be overemphasized.

As previously mentioned, oil does not, by itself, travel to the well bore. Some form of energy is required to move it through the rock, and when the energy available has been dissipated, whether efficiently or otherwise, no further oil may be produced. In the early days of the oil industry only a small fraction of the original oil in place was recovered from pools. The reasons for this are important. Lacking an agreement or requirement for orderly drilling and production, each oil property owner, for his own protection, engaged in a race with his neighbours to drill as many wells and produce as much oil as possible. Much waste of money



and equipment occurred through overdrilling and tremendous losses of oil resulted, both on the surface as a consequence of overproduction, and in the reservoir through minimum utilization of reservoir energy. Thus the "law of capture" and ignorance of the relationship between production rate and ultimate recovery fostered the inefficient and often deliberate dissipation of natural energy forces in most of the early-developed oil pools.

As the industry matured, it was found that some of these energy depleted pools could be revitalized by the introduction to the formation of gas or water under pressure thereby providing an artificial source of energy which moved additional oil to the well bore. The term "secondary recovery" came into existence at that time to describe such processes, and "primary recovery" was used in reference to that phase of production wherein only natural forces were used. With further experience, it was found more beneficial to artificially supplement the natural energy forces early in the life of a pool, rather than to await the completion of the primary recovery phase. Such augmentation of reservoir energy, now a well recognized recovery-improving technique in the industry, is still often referred to as "secondary recovery", although its original connotation has been lost. Other terms - "pressure maintenance", - "water flood", "gas



injection", etc. are also used to describe certain forms of artificial supplementation of reservoir energy but none of them are completely definitive of the various processes used. For the purposes of the following comments, the phrase "recovery stimulation" will be used, since all the various schemes for injection of gases and liquids are predicated on improving the recovery of oil and gas from the reservoir rock.

Recovery Stimulation:

From the preceding discussion, it will be apparent that a sixth group, Methods of Recovery Stimulation, must be added to the five groups of factors which determine the amount of recovery of oil from the pool. Oil recovery stimulation is receiving ever-increasing study in the industry as its benefits of increased reserves and attractive economics become well realized. According to a recent survey made in the United States by the Interstate Oil Compact Commission, an increase in recoverable oil of over four billion barrels can be attributed to recovery stimulation processes used in "stripper" wells alone, and these stripper well pools represent only about 20 per cent of the total United States reserves. Results of recovery stimulation processes show that recoveries may be increased to two or three times that expected under primary means, and there are producing pools where it is only through such stimulation



that the recovery of any oil can be made economic. It has therefore been a matter of paramount importance in the exploration of Alberta's oil and gas that the Oil and Gas Conservation Board should endorse and promote recovery stimulation in the Province.

THE CHAIRMAN: Would you like to stop here, Dr. Govier, and catch your breath?

A. Mr. Chairman, I have only one more paragraph to read, and then I believe Mr. McKinnon---

THE CHAIRMAN: Very well, carry on.

A. Well, Mr. McKinnon tells me I have still two or three more pages, so maybe I will have a glass of water.

THE CHAIRMAN: Yes. I think we will take a break now.

---A short recess.

THE CHAIRMAN: Gentlemen, shall we come to order?

Q. Dr. Govier, will you continue, please?

A. We are now on page 45, and the side heading is: Methods of Recovery Stimulation.

Most methods of recovery stimulation in oil fields have the same basic feature: the introduction under pressure of a fluid, either gaseous or liquid, through one or more drilled wells to the oil bearing formation at a point within, or in pressure



communication with, the oil saturated portion of the formation. The injected fluid moves from its point of injection, which has the higher pressure, through the formation to the areas of lower pressure - the bore holes of producing wells. In its passage it flushes ahead of it, and also carries along with it, the oil in the rock pores. Water is one of the most commonly used injection liquids because of its low cost, abundant supply, ease of handling, and similarity in flow characteristics to crude oil. Another common injection fluid is natural gas since it is often available in considerable quantities in association with, or as a by-product of, oil production. Other materials such as air, liquifiable petroleum gases and carbon dioxide have also been used for injection purposes, either by themselves or in conjunction with natural gas or water.

Laboratory experiments on samples of the porous rock from a reservoir give valuable data as to which fluid, or combination of fluids, will most efficiently flush the oil from the rock pores. These data can then be related to information on availability of the fluid, the economics of its injection and the structural configuration of the reservoir rock, to determine the optimum approach to recovery stimulation.

An important feature of recovery



stimulation through fluid injection is the location in the reservoir at which the fluid is injected. Being heavier than oil, water is commonly injected into a part of the formation that was originally water saturated, usually immediately beneath or in the down-structure flanks of the oil pool. Its effect is then to supplement an existing water drive and to extend the region being swept by water. Also, water is often used in a pattern flood, wherein water is injected into the oil zone itself through alternate rows or staggered arrays of wells for the purpose of laterally "flooding" the oil in the formation toward the producing wells. Such pattern floods are variously termed "five-spot", "nine-spot", "line-drive", etc., to describe the geometric pattern. If gas is the injected fluid, it is usually compressed and introduced to the crest of the reservoir structure where it may add to the amount and pressure of gas cap already there, or may form a "secondary" gas cap if none previously existed. Like water, gas is also used in the horizontal displacement of oil in pattern injection flood projects.

Of particular interest at the present time is some of the experimental work being carried out in the use of liquifiable petroleum gases, such as propane or butane, as injection fluids -- this is



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often referred to as a miscible flood. Laboratory experiments suggest that extremely high recoveries may be realized through the use of such fluids.



Administration of Recovery Stimulation:

Alberta's Oil and Gas Conservation Act empowers the Board to require that schemes for recovery stimulation be put into effect in order to prevent waste, and also specifies that no such scheme shall be proceeded with unless the Board has approved it. Where it can be demonstrated that additional recovery of oil can be attributed to the scheme, the MPR's or MER's of the producing wells would be increased accordingly to reflect the improvement in recovery. Within this policy the operators of wells in a pool under flood may look forward to increased allowables and improved income to defray the very considerable capital outlay which is often necessary to put a recovery stimulation plan into effect. Where reservoir engineering studies made by the Board's staff suggest that a scheme of recovery stimulation in a pool would increase the economically recoverable oil or prevent waste, the Board has held informal discussions on the matter with the pool operators and in most cases this has resulted in a voluntary scheme being put into effect. Where necessary the Board, after public hearing, has ordered that a suitable scheme be initiated.

Recovery Stimulation in Alberta: I think, perhaps, I should add at this point in most instances where recovery stimulation schemes are in effect they have been introduced, really, on the initiative



of the operators rather than on the direction of the Board.

There are a wide variety of full scale recovery stimulation schemes presently under way in Alberta including gas and water injection of various types. In addition, several other schemes have been approved by the Board and are in various stages of preparation. Two experimental schemes using liquefiable petroleum gases and solution gas have been commenced in the Pembina Cardium pool, and one small scale experimental water flood has been in effect for some years in the Turner Valley Field, with good results. At the end of 1957 the recoverable reserves attributed to seven gas and four water injection schemes increased from about five hundred million barrels to seven hundred million barrels, an increase of some two hundred million barrels or $6\frac{1}{2}$ per cent of the net recoverable reserves of the Province at that time. It is expected that this figure may be doubled in the next two or three years as additional projects prove their efficiency.

Finally, it should be pointed out that there are several dozen projects in operation throughout the Province where the water and excess gas that is produced with oil is being returned to the pool from which it is produced. While such schemes are not thought of as recovery stimulation projects but rather



as gas conservation or water disposal schemes, they are in fact beneficial to a small degree.

Mr. Chairman, that concludes my portion for the time being and Mr. McKinnon will carry on.

THE CHAIRMAN: Thank you very much, sir.

MR. MCKINNON: Mr. Chairman, I will proceed with the chapter Pooling and Unit Operations.

CHAPTER X

POOLING AND UNIT OPERATIONS

"Pooling" as used here and in the Oil and Gas Conservation Act means the combining of tracts that are within a spacing unit and that are subject to different ownership so that they may be operated as a unit to permit drilling and production within the spacing unit. "Unit operation" as defined in the Act means the operation in accordance with a scheme or plan for combining the interests of all owners in a common source of supply of oil or gas in any field, pool or part thereof, so that the operation may be conducted as if there were only one operator and one tract, and the cost of the operation and the oil or gas produced thereby are distributed among the owners or tracts according to a formula or a schedule of participation. Thus, the differences between the two are that pooling is on a spacing unit basis and unit operation is on a pool-wide basis and that their objects may be different. Each, however,



has the effect of a union for certain purposes of interests in property and each has the effect of modifying leases so that wells required to be drilled may be drilled upon adjacent property within the unit and so that the production used as a basis for royalty payment is altered.

In Alberta, as in most jurisdictions, the operator must have the right to produce oil or gas from all of the spacing unit before he can drill or operate an oil or gas well. Most oil and gas leases now contain a clause entitling the lessee to pool the oil and gas rights covered by the lease with others to make up the spacing unit. Sections 73 and 74 of the Oil and Gas Conservation Act, however, have provisions for compulsory pooling, which are necessary in cases where a lease does not contain a pooling provision or where the lessees or one of them does not agree to the pooling. (An alternative in some cases is an order making a special spacing unit that would comprise only part of the normal spacing unit.) An order providing for compulsory pooling would not alter the ownership of either the lessors or the lessees in tracts, but would combine their interests for the purpose of drilling and production and provide for apportionment of the costs and expenses and the allocation of production to various tracts. Normally, the apportionment and allocation within a spacing unit



are on a simple acreage basis. An order of the Board providing for compulsory pooling requires the approval of the Lieutenant Governor in Council.

A unit operation combines the interests of all the owners, both lessors and lessees, within the unit area. The object is to make possible some recognized and approved conservation procedure such as secondary recovery, underground storage or a more economical program of development of the field.

While unit operation is generally accepted as desirable in a proper case, it met considerable opposition in earlier years with the principal objection being that it tended to eliminate the smaller operators from field operations.

Under section 72 of the Oil and Gas Conservation Act an agreement among owners for a unit operation requires the approval of the Board before it is put into effect. In addition, sections 75 to 82 contain provisions that may be put into effect upon proclamation of the Lieutenant Governor in Council and that would empower the Board, with the approval of the Lieutenant Governor in Council, to order, on a compulsory basis, a unit operation.

While most of the advantages of the unit to the operators are obvious, it is sometimes necessary to work for years before a unit operation agreement can be concluded and quite often such an agreement is never concluded. The difficulties as far



as operators are concerned often centre on the basis of participation in the production. The same difficulty is in the way of the agreement of royalty owners and in that case there is also the reluctance to accede to variation in the leases which might prejudice them. If a compulsory unit operation order were made, its provisions would name the unit, define area prescribed, provide that the ownership of the various tracts is unaltered, combine the interests for the purpose of unit operation, provide for allocation of production, provide for an operating committee and the naming of a unit operator, provide for adjustment for investment in existing wells and installations and the share of unit expenses, and contain various other provisions covering related matters as plan of operation, the right of various owners to information, audits, title information and disputes, etc.

The Act stipulates that a compulsory unit operation order shall not come into effect until it has the consent of the owners of the drilling and producing rights in 75 per cent of the unit area and the consent of the owners of the head lessor's royalty interests in 75 per cent of the unit area.

CHAPTER XI

Gas and By-Products Utilization: Section
45 of the Oil and Gas Conservation Act provides that



"no gas produced in the Province shall be used or consumed in the Province for any purpose other than for gas lift, repressuring, recycling, pressure maintenance, or for light or as fuel, until a permit authorizing its use or consumption for another purpose is granted by the Board".

The purpose of this section is to prevent the inefficient or improvident use of gas including liquid hydrocarbons and also to guard against public nuisance (e.g. a carbon black plant using the inefficient channel process blankets the surrounding country with black soot).

The manufacture of carbon black is one of the uses which requires a permit. Until recently, the chief source of raw material for the manufacture of carbon black was natural gas. Since the cost of raw material with respect to capital and labour costs is relatively high, the industry was dependent on cheap natural gas supplies which, due to location or other circumstances, could not be used for other purposes. The Board has been prepared to give favourable consideration to an application to construct a carbon black plant in Alberta provided that an efficient process was employed. A few companies investigated the possibility of establishing a carbon black plant in Alberta in the earlier part of the decade but rising prices of natural gas and technological changes in the rubber industry have



detracted from the use of gas for this purpose.

The advances made in the use of carbon black manufactured from oil have permitted the establishment of such plants close to markets and further reduced the economic feasibility of establishment of a plant in Alberta. An oil black plant now is in operation in Sarnia, Ontario.

Natural gas and its by-products currently are being used as chemical raw materials in five large plants in the Province. Two of these produce ammonia based fertilizers as primary products while a third produces ammonium sulphate as a by-product. The versatile plastic polyethylene is produced in the fourth plant and cellulose acetate fibre and organic chemicals are produced in the fifth.

The large and increasing reserves of wet gas in Alberta assure the Province of an abundant supply of both the liquefiable petroleum gases (ethane, propane, butanes, butadiene) and sulphur as raw materials for the petrochemical industry.

Extensive growth in the manufacture of high unit-value petrochemical products such as polyethylene, is anticipated. The distance from Alberta to large consuming markets and the high freight rates, however, seriously militate against the economic production of low unit-value or bulk products. The plans of Polymer Corporation to manufacture butadiene from butane in a plant to be located near Red Deer are



indicative of the future. Other such "raw-material oriented" industries producing plastics and textile and other intermediates will undoubtedly be attracted by Alberta's plentiful and low cost fuel and raw materials.



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Propane is widely used as a fuel in rural homes and communities in Western Canada. A more recent use for both propane and butanes has been as injected fluids in oilfield pressure maintenance operations. Natural gasoline is used as a blending stock in refinery operations. A large obstacle in the path of orderly marketing of propane and butanes is the three to one winter to summer ratio of fuel requirements of the market area served and the higher rate of summer over winter production. Due to the extremely high cost of surface storage facilities for these products (approximately \$1.00 per gallon) it is necessary to re-inject them into a producing formation or to flare them. The development of suitable underground storage, where products stored in the summer months could be withdrawn and used without further processing to meet increased winter demands, would greatly aid Alberta LPG marketing.

Natural gas has been marketed in Alberta since the turn of the century and sales have increased steadily as our cities and towns have grown in size and as more and more communities have been served. While a large amount of industry has developed in the last decade, a substantial portion of the total Alberta requirements for natural gas is for domestic and commercial consumption. Due to the severity of Alberta winters, the ratio of



winter to summer heating requirements is high, resulting in an unusually low load factor market. The overall Alberta load factor for last year was estimated to be 54 per cent. In line with good conservation practice, the local utility companies have endeavoured to give priority in the market to oilfield gas to prevent flaring or reinjection. In some cases this has required the complete closing in of dry gas fields in the summer months.

The Board has taken a particular interest in the supply of natural gas to small communities within the Province. Its staff has made many detailed studies of the engineering and economic feasibility of providing gas service to towns and villages from the nearest gas wells or gas transmission lines. In some cases it has been possible to show that gas could be supplied in competition with alternative fuels and to assist the communities in arranging for gas service. In other instances it has been demonstrated that the cost of gas would not make it attractive to the potential consumer when compared in cost with coal, oil or propane. It has been suggested in these cases that the communities would do better to wait on the chance that further drilling or the construction of additional gas transmission lines would provide gas at a lower cost. A waiting period already has benefitted some communities.



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The Board also offers advice on the technical and economic aspects of gas supply to the Board of Public Utility Commissioners when that Board considers gas franchise applications.

Some markets outside the Province now are being served with gas released under the provisions of the Gas Resources Preservation Act. Generally the gas used to serve extra-provincial requirements will be produced at relatively high load factors due to the nature of the markets being served. The matter of gas "export" is discussed more fully in the next chapter.

Chapter XII, Removal of Gas From Province:
Gas produced in the Province may be removed from the Province only if the Board has issued a permit authorizing its removal under the Gas Resources Preservation Act, 1956 (Statutes of Alberta, 1956, c.19; Appendix B). The intent, purpose and object of the Act, as expressed in section 3, is "to effect the preservation and conservation of the oil and gas resources of the Province and to provide for their effective utilization having regard to the present and future needs of persons within the Province".

Any person who produces, acquires or has contracted for gas and intends to remove it from the Province may apply for a permit. Upon receipt of the application and such information as it



requires, the Board notifies the applicant of the time and place of hearing and its requirements for giving notice of the hearing.

After the hearing, the Board may, with the approval of the Lieutenant Governor in Council, grant a permit subject to prescribed terms and conditions, refuse the permit or defer consideration of the application. The Act prohibits the granting of a permit unless the Board is of the opinion that it is in the public interest to do so, having regard to the present and future needs of persons in the Province and to the established gas reserves and trends in growth and discovery of reserves in the Province. The terms and conditions of a permit may stipulate, inter alia, the period of the permit, the sources of gas, the quantities and rates of removal, conditions under which removal may be diverted, reduced or interrupted and the requirement to supply communities or customers within the Province under reasonable conditions. The Board may, upon a hearing, reconsider a permit and make such order thereupon as the Lieutenant Governor in Council approves. Unless the permittee has applied for the reconsideration he is entitled to sixty days' notice of such hearing.

The Act empowers the Lieutenant Governor in Council to make regulations to facilitate the administration of the Act and to place special



hydrocarbons (LPG's or bottled gas) under regulations instead of the provisions of the Act. Only the latter power has been exercised. (Alberta Regulations 6/57; Appendix B2).

The first public hearing held by the Board under the provisions of the Act (The Gas Resources Preservation Act, S.A. 1949 (2nd Session) c.2, in substitution for which present Act was enacted) commenced in November 1949. Individual and joint hearings of six separate applications by different companies for the removal of gas from the Province culminated in the Board's recommendation to the Lieutenant Governor in Council in March, 1952 that one of the applicants, Westcoast Transmission Company Limited, be permitted to export gas under certain terms and conditions. The details of the Board's recommendations are shown in the Report to the Lieutenant Governor in Council dated March 29th, 1952. Additional hearings have been held since that date and have resulted in the Board's recommendations that other companies be permitted to remove gas from the Province. In all, five Reports (Appendix L) to the Lieutenant Governor in Council have been made by the Board. The following is a summary of the existing permits granted by the Board to date:



Permittee	Maximum Daily MMCFD	Maximum Annual BCF	Total Au- thorized Withdrawal BCF
Peace River Transmis- sion Company Limited	6	0.6	13
Peace River Transmis- sion Company Limited	7	1.0	20
Westcoast Transmission Company Limited and Westcoast Transmission Company (Alberta) Limi- ted	190	56	1080
Canadian Montana Pipe- line Company	100	20	- *
Saskatchewan Power Corporation	83	18	223
Trans Canada Pipe Lines Limited	620	210	4350
	1006	305.6	5959

* All the gas from Black Butte, Comrey, Manyberries, Pendant d'Oreille and Smith Coulee fields. Reserves in these fields are presently estimated at 273 billion cubic feet.

At the public hearings the Board currently requires the applicant to present in support of the application exhibits and verbal testimony with respect to all phases of the proposed projects, including the following:

1. Evidence that at least 80 per cent of the gas proposed to be removed is under contract to the applicant and particulars of each of the gas purchase contracts;



2. The location and description of the pools, fields or areas within the Province from which it is proposed to remove gas;
3. The estimated reserves of gas in each such pool, field or area and the geological, engineering and other data used in the estimation;
4. The deliverability characteristics of the wells in each such pool, field or area and the geological, engineering and other data used in their determination;
5. A detailed deliverability schedule showing how it is planned to produce the quantities of gas proposed to be removed from the Province during the full period of the removal from each pool, field or area,
6. Evidence that the proposed removal of gas is in the public interest, having regard to
 - (1) the present and future needs of persons within the Province, and
 - (2) the estimated reserves and trans of discovery and growth of reserves of gas in the Province;
7. The route and design details and capital and operating costs of the pipe line facilities required to implement the



- proposed removal;
8. Cost with respect to the marketing areas to be served beyond the Province and the amounts of gas to be used for domestic, commercial and industrial purposes;
 9. Particulars of the contract between the applicant and the purchasers of the gas to be removed from the Province through facilities of the applicant;
 10. Particulars of the method of financing the proposed facilities.

At the conclusion of a hearing, the Board reviews the evidence submitted and also the work of its own staff with respect to the reserves of gas, the present and future needs of persons in the Province and methods of supplying the requirements.

The Board in its Interim Report in 1951 made the following recommendation concerning the protection of the present and future needs of the people of the Province:

"In view of the most favourable prospects
"of the Province for the discovery of
"additional extensive gas reserves and
"in view of the possibility of the de-
"velopment of alternative forms of fuel
"and energy, the Board believes that the
"Province will be adequately protected if
"sufficient reserves of pipe line gas are



"provided to maintain the supply and
"deliverability for thirty years."

The Alberta Government concurred in the Report.
Since that time the thirty-year requirement has been
adhered to.

The problem of supplying requirements re-
quires deliverability studies - the selection of
various pools and areas whose gas reserves may be
produced economically to meet the requirements of a
market at the time and in the quantities required
by the market. There may be considerable variation
between average day requirements and peak day re-
quirements in a market. As previously mentioned,
in Alberta the average consumption is approximately
45 per cent of the peak day. In preparing illustra-
tive deliverability schedules, it must be shown how
both annual and peak day requirements may be met.

The matter of selecting the reserves that
can best meet the requirements of any substantial
market is a complex one involving the preparation
of many alternative schedules, each based on a great
deal of detailed study and calculations. Considera-
tion must be given to proximity of the reserves to
the market or a main transmission line, the size of
the reserve, its reservoir characteristic and its
ability to produce in accordance with sound con-
servation practice.



The nature of the gas itself, whether it be dry gas or wet gas either associated with or non-associated with oil, is important in determining deliverability. It is the Board's policy to give, where practical, first market priority to gas produced unavoidably with oil and second priority to processed wet gas produced from wet gas and condensate fields. Gas processing plants are costly, and in order to operate economically must have a throughput load factor of not less than 70 to 80 per cent. With a large proportion of our reserves being wet gas, the ideal way to meet requirements would be to use wet gas for basic requirements and dry gas for peak loads.

In scheduling fields in a deliverability schedule, the Board follows a policy of assigning to each utility system the reserves of gas which are most suited to that system, having in mind distance from existing facilities and the type and deliverability characteristics of each reserve. In this manner it should be possible to reflect the lowest cost of gas to local consumers.

It is only after trying, by trial and error method, various combinations of the different types of reserves that a final deliverability schedule can be compiled indicating how the requirements of the Province can most efficiently be met and how any surplus reserves can be used to meet the



requirements of an applicant for "export". Of course, this final schedule can only be illustrative and would be subject to change with the development of additional reserves and changing markets.

After reviewing the evidence adduced at the hearing of an application and the comparative studies of its staff, the Board submits a report to the Lieutenant Governor in Council fully outlining the matters considered, its conclusions and the disposition it proposes to make of the application.

As an illustration of the analyses included by the Board in its report to the Lieutenant Governor in Council reference is made to the report (in Appendix L) dated November 24th, 1953. Appendix A of that report enlarges upon the findings of the Board concerning the current gas reserves of the Province and tabulates the reserves of the more important fields. In Appendix B is found a study supported by graphs showing the trends in exploration and the growth of natural gas reserves in Alberta. Appendix C details the method used by the Board in estimating the long term requirements of the Province for annual and peak day volumes of gas. Methods of meeting Alberta's requirements are discussed in Appendix D. The deliverability characteristics of the fields were estimated from all available test data. Using the deliverability reserves relationships as shown graphically in the appendix, illustrated deliverability



schedules were compiled. Table D-9, for example, shows one method in which the requirements of the Canadian Western Natural Gas Company Limited system could be met for the years 1953 to 1982 inclusive. In this manner the Board was able to determine which reserves were required for Alberta use and those which were surplus to provincial requirements.

In a similar manner deliverability schedules were developed to show how the requirements of the applicant could or could not be completely met from the remaining available reserves in the Province.

This served as a basis for the Board's recommendation and is illustrated in Appendix F of the report.

CHAPTER XIII

Transportation: Pipe lines that are subject to provincial jurisdiction are governed by the Pipe Line Act (R.S.A. 1955, Chapter 234). Broadly, this Act provides for

- (1) the granting, upon application to the Minister of Mines and Minerals, of a permit for the construction of a pipe line;
- (2) the acquisition by the permittee of such lands or interests therein as are necessary for the pipe line, under provisions administered by the Board of Public Utility Commissioners;



- (3) a declaratory order of the Board of Public Utility Commissioners permitting the operation of the pipe line; and
- (4) the authority of the Lieutenant Governor in Council to make regulations regarding pipe lines. (The regulations are administered by the Department of Mines and Minerals.)

A variety of provisions cover related matters, such as alteration and extensions of pipe lines or their routes, exemption from some provisions of the Act of gathering lines and service lines, penalties, etc.

For most purposes oil lines and gas lines are dealt with in the Act on the same basis. However, the Act provides for a closer examination of an application for a permit for the construction in the case of a gas line, and the consideration in such a case of the financial responsibility of the applicant, any public interest that may be affected by the outcome of the application, and the needs and general good of the residents of the Province as a whole.

The function of the Oil and Gas Conservation Board under this Act is to advise the Minister on an application for a permit for the construction of the line. The Board receives a copy of the application and submissions in support of it,



and may require further information of the applicant. The Board, after consideration of the application, notifies the Minister, in the case of a gas line, of its approval or disapproval and of any changes in the plan or details it deems expedient, and in the case of an oil line, of any objection it may have.

In the case of an application for an oil line permit, the Board's examination of the application and its report to the Minister are made from a technical point of view only.

Where an application for a gas line permit is received, the Board may, or may not, hold a public hearing with respect to it. It is the Board's practice to hold a hearing when applications may be in conflict, when there appear to be reasons why the applicant's plans may conflict with interests of other persons or when it appears desirable to extend the opportunity to make representations concerning the project, as in case of complexity or involving intangible factors.

Before a hearing, the Board requires the applicant to submit certain information which he will be expected to support at the hearing. This may include

- (1) data respecting the geology and reserves of the field or area from which the line will take delivery;



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- (2) a production forecast showing a reasonable projection of yearly production rates and the derivation of the allocation factors on which the forecast is based;
- (3) evidence of the suitability and acceptability of the gas to the proposed market;
- (4) route maps and particulars of the terrain to be traversed;
- (5) design material showing specifications, adequacy for foreseeable throughput, flexibility for increased throughput, economics of compressor horsepower related to line diameter, flow formula and characteristics of the fluid;
- (6) particulars regarding capital investment, operating and other expense items, suggested rates and methods of financing.

The Board's concern in dealing with an application for a gas line permit is that the project be sound from an economic and engineering point of view, considering the reserves, deliverability, design and markets, and that it is in the public interest.

A submission to your Commission dealing with other phases of the administration of the Pipe



Line Act has been made by the Department of Mines and Minerals.

Some provisions of the Oil and Gas Conservation Act (Appendix A1) also may affect a pipe line operation. Section 42 of that Act empowers the Board, with the approval of the Lieutenant Governor in Council, to declare the proprietor of a pipe line to be a common carrier. Under section 43, the Board, with the approval of the Lieutenant Governor in Council, may declare a person who purchases, produces or otherwise acquires oil or gas in a pool to be a common purchaser of oil or gas from the pool or pools designated by the Board. The Board, under section 46, may, after a hearing, order the owner or operator of a well, gas pipe line or processing plant to process, gather, deliver, buy or sell gas and construct the necessary facilities. An order under section 46 is subject to appeal to the Appellate Division of the Supreme Court of Alberta. In the event that agreement cannot be reached as to price to be paid for gas upon a purchase or sale ordered under section 46 or the charges to be paid for processing the gas, the Board of Public Utility Commissioners, on the application of any person interested, may determine the price or charges.

My colleague, Dr. Govier, will continue



with Chapter XIV, sir.

THE CHAIRMAN: Thank you.

MR. GOVIER: This is Chapter XIV, Reserves of oil and gas and trends in growth of reserves.

There are two fundamentally different, but not completely independent methods for estimating the recoverable reserves of oil or gas in an underground reservoir. These are the volumetric and the material-balance methods. The volumetric method involves

- (a) the estimation of the gross volume of the hydrocarbon containing reservoir through the determination of its areal extent and thickness,
- (b) the calculation of the oil or gas contained in the reservoir through a knowledge of the rock porosity and the relative saturations of oil, gas or water,
- (c) the estimation of the fraction of the oil or gas in the reservoir which may be recovered,,
- (d) the correction of the recoverable oil or gas volume to atmospheric or standard conditions of pressure and temperature, and
- (e) in the case of gas, the deduction of appropriate processing and operating



losses to give the "marketable" figure.

The material-balance method is an application of the law of conservation of mass to the fluids originally contained in the reservoir. It may be employed successfully only to reservoirs from which a significant amount of measured production has been obtained and for which extensive pressure history is available. In many cases the calculation is mathematically quite complex, in others (and especially in certain gas reservoirs), it may reduce to a simple graphical procedure involving a "pressure-decline" curve for the pool.

Estimation of Reservoir Volumes: The productive area of a reservoir is determined by geological studies, consisting of the correlation of logs, the identification of fluid interfaces and the preparation of structural contour maps. In some instances, access to seismic maps facilitates the construction of the structural contour maps. For a single well reserve, it is impossible to delineate the productive area accurately and judgment must be used.

The productive thicknesses and average porosities at wells within a reserve area are determined from both core analyses and logs, considered along with drill stem test and production data. Wherever possible, isopachous (equal-thickness) maps are prepared. The limiting



isopach is drawn at the estimated areal limit of the reservoir. The interior isopachs are controlled by the productive thicknesses calculated for each well. The volume of the hydrocarbon containing reservoir rock is calculated from the isopachous map.



II

Reservoir Engineering Factors: Many factors related to the properties of the reservoir and its fluids and the reservoir pressure and temperature are important to the reserve estimate. The reservoir properties of porosity and fluid saturations are determined by interpretation of logs and by laboratory analysis of cores taken during the drilling of wells. The properties of the fluids including gas solubility in oil, oil gravity and compressibility, gas gravity and compressibility, and others are obtained by laboratory analysis of carefully collected fluid samples.

More difficult than any of the other factors to determine is the recovery factor. This must be estimated from a knowledge of the reservoir conditions, and in the case of oil especially, is extremely sensitive to the reservoir drive. Theoretical analyses, laboratory tests and the performance of similar reservoirs all aid in judging the recovery that may be expected.

Classification of Reserves: When an estimate is made by the volumetric method, the areal extent and often other factors must be determined with the aid of judgment. A rather common practice is to separate an estimate into two parts -- the proven reserve and the probable reserve. The term proven generally is used with reference to that part of an area or reserve closely defined by



productive wells and geological interpretation. The area or reserve lying beyond this, less well defined but considered likely to contain oil or gas, is called "probable". Every estimator has his own ideas on where to draw the difficult line between "proven" and "probable".

A reserve determined by the material balance method usually is considered proven because it represents the quantity of oil or gas necessary to explain the pressure-production history of the reservoir.

The Board has adopted certain rather definite policies for its own use. For one-well pools the Board usually assigns as proven, 500 to 1,100 acres to a gas reserve and one spacing unit -- which may be 40 acres, 80 acres, or 160 acres -- to an oil reserve. The Board also has accepted the principles and classifications used by the American Petroleum Institute and the Canadian Petroleum Association as they apply to oil reserves. The important points among these principles and classifications may be summarized as follows:

The reserve estimates for oil are made annually and refer solely to proven reserves and include only oil and condensate recoverable under existing economics and operating conditions. The proven reserves include both drilled and undrilled reserves. The proven drilled reserves, in any pool,



include the oil estimated to be recoverable by the production systems now in operation and from the area actually drilled on the spacing pattern in effect in that pool. The proven undrilled reserves are those under undrilled spacing units which are so close and so related to the drilled units that there is every reasonable probability that they will produce when drilled.

The oil reserve estimates do not include

- (a) oil under the unproven portions of developed fields;
- (b) oil in untested prospects;
- (c) oil that may be present in unknown prospects in regions believed to be generally favourable;
- (d) oil that may become available by "secondary recovery" fluid injection methods from fields where such methods have not yet been applied and proven; -- I would particularly draw the attention of the Commission to Item (d) --
- (e) oil that may become available from oil sands, oil shale, coal or other substitute sources.

This last Item (e) means, of course, that the oil reserve figures for the Province of Alberta do not include an estimate for the Athabaska oil sands.

In the case of new discoveries made during the year, the estimates of proven reserves in many cases necessarily represent only a fraction of



the reserves which may ultimately be assigned to the new discoveries.

Reserves of condensate, recovered from the separators of gas and condensate wells, are included with those of oil but under separate classification. Condensate reserves are determined using the condensate to natural gas ratio applied to the estimate of recoverable natural gas. The condensate to natural gas ratio is obtained from production tests on wells in the pool.

In the case of gas reserves the Board has found it convenient to define what it calls "established" reserves. These are the proven reserves plus a judgment portion of the probable reserves giving a total which may reasonably be depended upon. The portion of the probable figure may vary from a small to fifty or more per cent depending upon circumstances. The Board believes its "established" gas reserve figures to be consistent as between pools and to be safe and conservative figures although not in all cases wholly proven.

Reserves of Oil and Condensate: A review of the growth in reserves of Alberta oil and condensate indicates that as of December 31st, 1957, the Province has net proven reserves of some 3.1 billion barrels. The distribution of the remaining recoverable reserves of oil and condensate by broad gravity ranges as of December 31st, 1957, as



follows:

<u>Type</u>	<u>Millions of Barrels</u>
Light and Medium Oils	2,893
Heavy Oil	34
Condensate	<u>185</u>
Total	<u>3,112</u>

The above figures represent the total of the estimates for all the individual pools in the Province. Each estimate is based on all available data on reservoir and production characteristics and refers to proven economically recoverable reserves.

With the addition of an estimated cumulative production of 812 million barrels, the total virgin reserves discovered to date amount to some 3.9 billion barrels. The increase in virgin recoverable reserves during 1957 was approximately 283 million barrels of which some 66 million barrels is attributable to newly discovered pools. The net increase in recoverable reserves during 1957 is in excess of 146 million barrels.

Potential Production and Actual Production of Oil and Condensate: The maximum efficient rate -- that is, MER or MPR, as the case may be -- of oil production for the Province based on a sound engineering appraisal of individual pools averaged some 756,000 barrels per day in 1957. This is an increase of 76,000 barrels over the efficient rate



for the previous year. The present production potential is estimated to be 787,000 barrels per day. When related to the actual 1957 production of 376,000 barrels per day, the average annual production potential exceeded production by some 380,000 barrels. The unproduced proportion of the production potential of the Province has increased from 30 per cent in 1954 to 50 per cent in 1957.

The details of the trends in the growth of the potential production and the actual production for the Province are contained in Appendix M.

Trends in Growth of Oil Reserves: When related to the 438 wildcat wells drilled in 1957 the 283 million barrels increase in virgin recoverable reserve of oil and condensate for the year indicates an average discovery rate of 646,000 barrels for each wildcat drilled. This may be compared to a discovery rate of 1,581,000 barrels per wildcat well in 1956. The 4,045 wildcats drilled to date when related to the year-end cumulative virgin recoverable reserves indicate an average discovery of some 970,000 barrels for each wildcat drilled.

I might interject that this kind of wildcat well includes all wildcat wells whether they have been drilled for oil or gas, and whether they got water or oil or gas. It is expected that on the average the discovery rate will remain near



the present figure for some years and then will decline as the remaining undiscovered reserves decrease, or as more of the oil is found. Coupled with estimates of the rate of drilling and the ultimate total wildcat wells these figures lead to an estimated ultimate oil reserve of some 15 billion barrels. This figure is on a virgin basis, i.e. it would include all production. It is conservative in that it makes little allowance for increases in recovery which undoubtedly will accompany growth in "secondary recovery" methods.

MR. PATTILLO: Excuse me, Dr. Govier. I see you are now going to start on the reserves of gas, and I think this would be a good place at which to break off, if the Chairman agrees.

THE CHAIRMAN: Yes, I think if you would not mind breaking here, Doctor, we can adjourn now and meet again tomorrow morning at 9.45. Will that suit your convenience, Dr. Govier?

THE WITNESS: Thank you.

---Whereupon the hearing adjourned at 4.31 P.M.
until 9.45 A.M., Wednesday, 5th February, 1958.

Mr. Borden

ROYAL COMMISSION

ON

ENERGY

HEARINGS

HELD AT

CALGARY,

ALTA.

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TORONTO, ONTARIO

ROYAL COMMISSION

ON

ENERGY

Hearings held at Calgary,
commencing Monday, February
3, 1958, at 10.00 A.M.

PRESENT:

Mr. H. Borden, C.M.G., Q.C.	--	Chairman
Mr. J.L. Levesque,	--	Member
Mr. G.E. Britnell,	--	Member
Mr. G.G. Cushing,	--	Member
Mr. R.D. Howland,	--	Member
Mr. L.J. Ladner, Q.C.	--	Member
Dr. R.M. Hardy,	--	Member

COMMISSION COUNSEL:

Mr. A.S. Pattillo, Q.C.

Mr. Miles H. Patterson.

Mr. J.F. Parkinson -- Secretary to the
Commission.

Major N. Lafrance -- Assistant Secretary
to the Commission.



APPEARANCES:

Representing the Oil and Gas Conservation
Board, Province of Alberta. (Continued):

Mr. I.N. McKinnon	- Chairman
Mr. D.P. Goodall, P.Eng.	- Deputy Chairman
Dr. G.W. Govier, P.Eng.	- Member
Mr. N.A. Macleod	- Solicitor
Mr. D.R. Craig	- Reservoir (Oil) Engineer
Mr. J.R. Pow	- Geologist
Mr. J. Stabback	- Gas Engineer
Mr. A.F. Manyluk	- Development Engineer
Mr. R.J. Cooper	- Statistician



Wednesday,
February 5, 1958.

---Upon resuming at 9.45 a.m.

THE CHAIRMAN: Gentlemen, we shall resume the hearings. Mr. Govier, will you proceed?

MR. GOVIER: Mr. Chairman, we are dealing with page 79 and the side heading is Reserves of Gas.

The Board has made several comprehensive studies of the gas reserves of the Province in conjunction with applications it has heard on gas export. The findings have been included in reports to the Lieutenant Governor in Council and in two special reports entitled "Natural Gas Reserves of the Province of Alberta and Other Related Data" dated November 1st, 1955, and January 31st, 1957. These appear in Appendix L. It is expected that a new summary of the Board's findings with respect to gas reserves will be published in connection with its recommendations to the Lieutenant Governor in Council at the conclusion of the current export hearings.

For present purposes, the Board staff has prepared a tabulation of its estimates of natural gas reserves as of December 31st, 1957. The estimate generally is consistent with previous ones but does not represent a finding of the Board with respect to the current gas export applications.



Details of the estimate appear in Appendix I.

The staff estimate of established reserves for the Province as at December 31st, 1957, is some 21 trillion cubic feet. This represents an increase of about 2.7 trillion cubic feet since September 30th, 1956 -- or a growth at the rate of 2.16 trillion cubic feet per year. The staff has classified its estimate as follows:

- | | | |
|-----|--|--------------------------|
| (1) | Reserves presently considered within economic reach | 18.3 trillion cubic feet |
| (2) | Reserves presently considered beyond economic reach | 1.3 TCF |
| (3) | Reserves subject to lengthy deferment due to production of oil or due to reinjection | <u>1.4</u> TCF |
| | Total Reserves | 21.0 TCF |

Reserves of Natural Gas Liquids: A breakdown of the total gas reserve figure by categories of gas related to the content of recoverable liquids appears with details of the recoverable reserves of propane, butane and natural gasoline in Appendix J. The total estimated reserves of these liquids recoverable from the 21.0 trillion cubic feet of gas reserves are

Millions of Gallons

Propane	5,090
Butanes	4,800
Pentanes plus	5,660



for a total of 15.55 billion gallons.

Trends in Growth of Gas Reserves: The recent increase in gas reserves at the rate of 2.16 trillion cubic feet per year may be related to the 438 wildcat wells drilled during 1957. The actual gas reserve growth per wildcat well drilled is just under 5 billion cubic feet. When it is recognized that the 1957 discoveries are not yet nearly fully evaluated this figure confirms the conservation of the Board's previously reported opinion that the Province can safely anticipate a growth rate of 6 billion cubic feet per wildcat well for the next several years. Such a growth rate, coupled with an estimate of the rate of drilling and the ultimate number of total wildcat wells leads to an estimated ultimate gas reserve of 60 to 80 trillion cubic feet. This figure is on a virgin basis, i.e. includes all production.

Further details of the trends in growth of gas reserves appear in Appendix M.

Mr. Chairman, the next section will be read by Mr. McKinnon.

THE CHAIRMAN: Thank you, very much, Mr. Govier.

MR. MCKINNON: Mr. Chairman, this is Chapter XV, Records and Statistics: The Board keeps records and statistics on all aspects of the licensing, drilling and production activity for



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all wells drilled in the Province. The well name register, the well history and completion records, the well production records, together with pipe line, transporter, purchaser, oil refinery and gas plant records, form the basis of many secondary records and statistics on the geological, engineering and marketing phases of the oil and gas industry in the Province.

The geological classification of wells, described in Appendix O, is a useful tool in statistical analyses.

Figure XV-1 presents in chart form these records and statistics and indicates the broad relationship that exists between the primary records and the various supplementary records, statistics, studies and publications of the Board.

Mr. Chairman, do you wish me to read all these details?

THE CHAIRMAN: I do not think so; I think we could take them as read.

MR. McKINNON: I would like to make one comment in regard to page 84, the bottom of the page, subsection (g) pool performances and pool experience records.

As a service to industry, the Board publishes a semi-annual series of Reservoir Performance Charts of the significant oil pools in the Province.



Each performance chart is a graphical portrayal of the history of the pool since discovery, and gives pool average data on daily rates of oil production, periodic reservoir pressures, and monthly average water-oil and gas-oil ratios. The chart also shows the number of wells produced each month, and the cumulative oil production from the pool. Where applicable, the rate and cumulative amount of water and/or gas injection also is shown.

The charts are brought up-to-date every six months and published a few weeks prior to the Board's semi-annual MPR hearings. Each operator in the Province is mailed a complete set of charts and from them he may acquaint himself with the general behaviour and producing characteristics of most of the pools in the Province.

If it would be of interest to the Commission, the Board could file with the Commission a set of those charts.

THE CHAIRMAN: Yes, indeed, if you would: we would appreciate it very much.

MR. MCKINNON: We will be issuing a new set of charts in about two weeks and we could file a complete set of charts.

THE CHAIRMAN: Thank you very much, sir.

MR. MCKINNON: The next chapter is



Chapter XVI, Procedure of the Board: As may be surmised in perusing the Oil and Gas Conservation Act and the regulations thereunder, the Board in its functioning issues numerous orders and directions. Some of the orders, namely, proration orders and compulsory pooling or unit operation orders require the approval of the Lieutenant Governor in Council. Orders of a "legislative nature" are filed under the Regulations Act.

In most cases the Board holds a hearing before making an order or direction, but unless the regulations specifically require a hearing, the rule may be varied. However, the Board holds a hearing whenever it appears that there may be some interest other than that of the applicant that may be affected or where for some other reason the Board considers a hearing desirable. For example, the Board might not have a hearing before making an order limiting pit disposal of water as such an order would simply specify how good production practices were maintained. But on the other hand, when the Board makes an order establishing, in a field or area, a spacing unit different from that prescribed in the regulations, it first holds a hearing, as a variation from standard conservation rules is involved.

In cases that it considers suitable, the Board may appoint examiners to conduct a



hearing, but in such a case an interested person has the right to ask the Board to conduct the hearing. Where examiners are appointed they usually conduct the whole of the hearing rather than some separate phases of it.

The Board endeavours to give sufficient notice of a hearing to enable each interested person to know what will be dealt with and to prepare any submission he may wish to make, and at the hearing gives each party the opportunity to present whatever he wishes to say and to hear whatever the other interested parties wish to submit.

The Board in the conduct of its hearing is not bound by legal rules of evidence. As a result, some evidence that would not be acceptable in a court is heard by the Board and this is considerable advantage where much of the evidence to be considered is in a nature of opinion evidence of experts. If a proposed witness fails to comply with a notice by the Board to attend, the Board may apply to a judge of the Supreme Court of Alberta for the issue of a bench warrant.

In addition to its "formal" hearings, the Board upon occasion may meet with operators to discuss the formulation of a policy or the development of a situation that may lead to a Board order or a direction. Thus, if the Board felt that a point was being approached where pressure



maintenance in a pool was desirable its first step would be to discuss the matter with the operators in the pool. This would give the operators an opportunity of considering the matter if they had not already done so and of formulating a voluntary program if they agreed that the pressure maintenance was desirable.

A provision is made in the Act for rehearings and appeals. Under section 118, a person affected by a Board order may apply for a rehearing within 45 days. Section 119 provides for appeals to the Appellate Division of the Supreme Court of Alberta. An appeal on the question of jurisdiction may be taken from any order made under Part IV or Part V of the Oil and Gas Conservation Act. These Parts deal with drilling, production, transportation and disposition of oil or gas, and the right to appeal on the question of jurisdiction affects most orders. In addition, an appeal from an order under section 37 or 46 may be made to the Appellate Division on the basis that there was insufficient evidence or that the order was wrongly made.

There is one type of Board order that is subject to a procedure entirely different from the others due to its emergency nature, and that is an order under section 123 closing an area to travel where hazardous conditions exist, such as those that arise in a case of a well flowing uncontrolled.



The procedures and procedural powers provided for in the Oil and Gas Conservation Act are applicable to hearings by the Board under other Acts.

Orders of the Board, when issued, are numbered and the number is prefixed by a symbol indicating the type of order.

Mr. Chairman, there follows a list of classifications; would you like me to read them?

THE CHAIRMAN: I think we can take them as read.

MR. McKINNON: Thank you, very much.

This may assist in a classification on the following basis:

1. Approved by Order in Council and filed under Regulations Act:

P orders - compulsory pooling

Compulsory unit operations orders (if and when)

Common carrier and common purchaser orders

2. Approved by Order in Council and not filed under Regulations Act:

No orders -- oil prorationing

MDS orders - transfer of allowable of wells capable of oil production but used for conservation purposes.

Permits under Gas Resources Preservation



3. Not approved by Order in Council but
filed under Regulations Act.
- F orders -- designating fields
- G orders -- designating pools
- SU orders -- prescribing spacing units
other than normal
- W orders -- restricting surface disposal
of water in fields or areas
- GC orders -- requiring gathering, pro-
cessing and either marketing or
storage of gas
- Misc. orders -- requiring pressure main-
tenance or the like in a
field or pool.

Orders under section 46 requiring purchase,
sale, transportation, processing,
etc. of gas.

- 4 Not approved by Order in Council and
not filed under Regulations Act:
- C orders -- closing in a well
- FH orders -- closing hazardous area to
travel, under section 123
- GA orders -- gas allowables
- LL orders -- gas allowables in Lloydminster
Field
- MH orders -- gas allowables in Medicine Hat
Field



Misc orders - orders (other than C orders)
made upon infractions of Act
or regulations, orders re-
lieving from off-target
penalties, etc.

Permits under section 45 authorizing use
or consumption of gas

Approval of schemes under section 38 or
of agreements for unit operations.

Mr. Chairman, I believe you would like
to have the Appendices I, J and M read?

MR. PATTILLO: That is my suggestion.

THE CHAIRMAN: I think we would wish it,
yes, if it is not too much of a burden.

MR. McKINNON: In that case, Mr. Govier
will read it.



MR. GOVIER: Mr. Chairman, the three appendices lettered I, J and M all give details which were referred to in Chapter XIV relating to the reserves of oil and gas and trends in growth of reserves.

Appendix I, which I will read first, gives a summary of the details of the staff estimate of gas reserves December 31st, 1957.

The Board has published estimates of the natural gas reserves of the Province of Alberta on six occasions commencing with its first Report to the Lieutenant Governor in Council in 1951. An up to date summary of the Board's finding with respect to established reserves will be published at the conclusion of the hearings of the present applications for permits to remove gas from the Province. In the meantime, the Board staff has prepared a tabulation of its estimates of natural gas reserves as of January 1st, 1958. It estimates that the present total reserves of natural gas are 21.0 trillion cubic feet, an increase of 2.7 trillion cubic feet over those estimated in the Board's January, 1957, report.

An examination of the reserves shows that about 55 per cent of the 2.7 trillion cubic feet increase is attributable to new discoveries and the balance to a net increase of previously known reserves. The discovery of the Pine Creek and Waterton reserves account for over half of the increase due



to new discoveries. Increases due to adjustments of previously known reserves were greatest at Bindloss, Calgary, Carbon, Medicine Hat, Savanna Creek and Westeros South fields. These were partially offset by downward revision in reserves at Harmattan-Elkton, Pembina, Pincher Creek and Windfall.

The total disposable natural gas reserves of 21 trillion cubic feet may be classified as follows -- the following classification appeared in Chapter XIV:

(1) Reserves presently considered within economic reach	18.3 TCF
(2) Reserves presently considered beyond economic reach	1.3 TCF
(3) Reserves subject to lengthy deferment due to production of oil or due to re-injection	<u>1.4 TCF</u>
Total reserves	21.0 TCF

In Table I-1 are individually listed all reserves estimated by the Board staff to be 10 Bcf or greater, plus, some smaller reserves of special interest. At the end of the table are summarized the reserves of 46 small areas whose individual reserves are less than 10 Bcf and which are considered to be within economic reach and those of 136 small areas which are presently considered to be beyond economic reach.

Mr. Chairman, if I may suggest that the



members of the Commission now take the first page of Table I-1, I would like to make some explanatory comments of the Table, and I will do so first by reading the remainder of the text material which relates directly to the Table.

Column 1 presents the name of the field or the area.

Column 2 presents the name of the geological formation or zone from which gas is obtained. The stratigraphic relationship of these formations is shown in Figure III-2, which appeared in Chapter III of the text.

Column 3 gives an estimate of the original gas in place expressed in billions of cubic feet at standard conditions. In cases of fields or pools from which gas production has been taken, column 3 also gives, as a second figure, an estimate of the remaining gas in place in the reservoir.

Column 4 gives the discount to be applied to the original gas in place to account for the gas left in the reservoir at abandonment.

Column 5 presents the discount to be applied, after that for reservoir loss, to account for surface loss. This factor includes, where applicable, allowance for gas flared, operational loss, field and/or plant fuel, and processing shrinkage attending the removal of carbon dioxide, hydrogen sulphide, propane, butanes and pentanes plus. I have made a slight



correction to the text there.

Column 6 gives the staff estimate of the disposable gas reserves as at January 1st, 1958. The figures are all expressed in billions of cubic feet at standard conditions. I might mention that the standard conditions used by the Board for all gas reserve figures are a pressure of 14.40 pounds per square inch absolute, and a temperature of 60 degrees Fahrenheit.

I believe, Mr. Chairman, I might further explain the Table by reference to a particular field and a discussion of the actual entries for that field.

Perhaps we should look at the Athabaska field which appears on the first page of Table I-1. There are two figures entered under column 3. The figure of 4.9 billion cubic feet represents the Board's staff estimate of the original gas in place in the reservoir. The second figure, 4.1 billion cubic feet, represents the Board's staff estimate of the gas which as of January 1st, 1958 now remains in the reservoir. The figure of 15 appearing under column 4 represents the estimated percentage of the original gas in the ground not recoverable; or, looking it in the converse, this figure indicates that 85 per cent. of the original gas in the ground is estimated to be recoverable. In column 5, the figure of 5 per cent. indicates the estimated



surface or operational loss. In this case the gas is dry: it requires no processing other than dehydration, and the surface or operational loss is virtually at a minimum. The application of the 15 per cent. reservoir loss and the 5 per cent. surface loss to the 4.9 billion cubic feet of original gas in place would give a figure from which, if cumulative production were subtracted, one would arrive at a figure of 3.2 billion cubic feet which appears in column 6.

The entries throughout this Table for other fields are almost comparable to that, Mr. Chairman, and I think, perhaps, that will serve to explain.

THE CHAIRMAN: Oh, yes. I don't think we need go through all of them. This is a typical one, in your opinion, and it is quite sufficient.

MR. GOVIER: One other comment, perhaps, I should make, Mr. Chairman, is that in the case of a gas which does require extensive processing, for example, the Acheson Leduc D.3 solution gas, the surface discount is a high figure, and that figure takes into account the normal operational losses plus the processing shrinkages attending the removal of hydrogen sulphide and the recovery of any liquid hydrocarbons.

THE CHAIRMAN: That is the 45 discount?

MR. GOVIER: In that case, Mr. Chairman, it is the figure of 25 per cent.: the Acheson Leduc



D.3 solution.

THE CHAIRMAN: I beg your pardon, yes.

MR. GOVIER: The 45 per cent. reservoir discount is high there because this is solution gas and the recovery of solution gas from the reservoir is invariably less than the recovery of gas cap gas or unassociated gas.

It might be of interest to look at the last page of Table I-1 where there are certain general notes. I believe, Mr. Chairman, I would like to read these.

Note 1: Unless otherwise noted reservoir loss is calculated as 10% of original gas in place except in particular cases where the following losses pertain: sand thickness 10-15 feet; reservoir loss 15%; sand thickness 5-10 feet; reservoir loss 20%; sand thickness 0-5 feet; reservoir loss 25%.

Note 2: Surface loss is taken as 5% for all dry gas, and varies for wet gas depending upon its composition.

Note 3: There is no need to read that.

Note 4: Unless otherwise noted surface discount factors in excess of 5% are due to extraction of heavy hydrocarbons.

Mr. Chairman, if you consider that is sufficient explanation of Table I-1, I will proceed to Appendix J.

THE CHAIRMAN: That would be the wish of the Commission, thank you very much.



Appendix J: Staff estimate of reserves of liquid hydrocarbons, December 31, 1957.

A trend in the distribution of gas reserves by types has become evident in the past few years. By classifying each gas reserve into four types of gas, the percentage distribution among types as of 1950 and as of 1957 is as follows.

There follows a table from which I would like to highlight the following points: the percentage distribution of dry gas has decreased from 58 per cent. in 1950 to a current figure of 50 per cent. On the other hand, the percentage of condensate gas and associated and solution gas, in all but the first case, has increased. The condensate gas has actually undergone some decrease from 27 per cent. to 24 per cent. but the associated gas and the solution gas have increased from 9 to 16 per cent. and from 6 to 10 per cent.

The important point here is that more and more of the reserves of gas in Alberta are of the wet type, requiring extensive processing.

<u>Type of Reserve</u>	<u>Percentage of Total Reserves</u>	
	<u>1950</u>	<u>1957</u>
Non-associated "Dry" gas	58	50
Condensate gas	27	24
Associated gas	9	16
Solution gas	6	10

It may be seen that the percentage of dry gas reserves has declined from 58 in 1950 to 50 in



1957. With the apparent shifting of exploration from the plains area to the foothills and mountain areas of the Province it is expected that more "wet" gas reserves will be discovered and that the percentage of gas requiring processing for removal of liquid hydrocarbons will increase beyond the current 50 per cent. of total reserves. The reserves of the liquid hydrocarbons are directly dependent upon the reserves of condensate, associated, and solution gas.

The word "condensate" is used in the adjectival sense in that expression; that is, it is condensate gas that is referred to.

The liquid hydrocarbon reserves as of December 31, 1957, are estimated to be 15,550 million gallons. The recoverable reserves are classified as follows.

There follows a table which has already been read, so I will pass over, Mr. Chairman.

(1) Propane	5,090 million gallons
(2) Butanes	4,800 million gallons
(3) Pentanes Plus	5,660 million gallons

A breakdown of the reserves of liquid hydrocarbons by fields is shown in Table J-1. The following method was used to estimate the recoverable liquid hydrocarbon reserves in the fields where there are no plants at present.

- (1) Recoverable propane estimated to be 50 per cent. of propane in the producible gas



reserves.

- (2) Recoverable butanes were taken to be 90 per cent. of the total butanes in the producible gas reserves.
- (3) Recoverable pentanes plus (that is, natural gasoline) was estimated to be 100 per cent. of pentanes plus present in the producible gas reserves.

In the fields where plant statistics were available, such as the Leduc field, average recoveries were used to estimate the recoverable liquid hydrocarbon reserves.

We might now take a quick look at Table J-1. This table lists, in the left hand column, the name of the field and, in the three other columns, the estimated recoveries in millions of gallons of propane, butanes and pentanes plus, or natural gasoline.

TABLE J-1
RESERVES OF LIQUID HYDROCARBONS FROM
NATURAL GAS IN THE PROVINCE OF ALBERTA

DECEMBER 31, 1957

<u>Field</u>	<u>Recoverable Propane Million Gallons</u>	<u>Recoverable Butanes Million Gallons</u>	<u>Recoverable Pentanes Plus Million Gallons</u>
Acheson	85	45	20
Alhambra	30	25	15
Bonnie Glen	630	440	260
Calgary	10	10	10



Campbell-Namao	15	10	5
Cessford	-	-	190
Crossfield	50	55	55
Eagle Hill	20	15	15
Erskine	25	15	20
Fenn-Big Valley	75	115	60
Gilby	80	70	50
Glen Park	15	15	10
Golden Spike	160	130	60
Harmattan-Elkton	525	655	540
Homeglen-Rimbey	335	440	440
Hussar	-	-	15
Innisfail	30	30	10
Jumping Pound	-	-	75
Leduc-Woodbend	845	585	295
Morinville	25	20	10
Nevis	215	220	195
Pembina	415	280	205
Pincher Creek	320	370	400
Provost	-	-	35
Redwater	200	200	75
Sarcee	25	15	25
Stettler	15	25	10
Sturgeon Lake	20	20	10
Sturgeon Lake South	85	70	25
Sundre	20	15	10
Turner Valley	110	-	355*
Waterton	120	220	1,650



West Drumheller	30	25	10
Westerose	140	140	75
Westerose South	35	25	25
Westward Ho	25	20	10
Wimborne	105	170	125
Windfall	95	165	195
Wizard Lake	<u>160</u>	<u>145</u>	<u>70</u>
TOTALS	5,090	4,800	5,660

* 45# RVP Product

I will now continue with Appendix M.

THE CHAIRMAN: Just a minute. At the bottom of that second page of the tabulation, where you total the number of millions of gallons and so on, what does that asterisk mean?

MR. GOVIER: Mr. Chairman, that is a footnote that applies to the estimated recoverable reserve of pentane plus in the Turner Valley field and, in that connection, the pentane plus is recovered in the form of a rather high vapor pressure natural gasoline product, and this simply indicates the product is a 45-pound Reid vapor pressure product.

THE CHAIRMAN: Thank you.

MR. GOVIER: Appendix M, trends in the growth of virgin recoverable reserves of oil and condensate and natural gas in the Province of Alberta: Present reserves of oil and condensate.

A review of data on the recent growth of Alberta oil and condensate reserves shows that as



of December 31, 1957, the drilling of a total of 4,045 wildcat wells has resulted in the discovery of some 4 billion barrels of recoverable virgin reserves of oil and condensate. The increase in new reserves during 1957 amounted to some 283 million barrels, of which some 66 million barrels is attributable to newly discovered pools or fields. Data for the past five years shows that an average of approximately 423 million barrels of new or additional reserves have been added to the total virgin reserves each year.

The remaining recoverable reserves and condensate after allowance for the cumulative production of some 812 million barrels are estimated to be about 3.1 billion barrels as of December 31, 1957. The net increase in remaining reserves during 1957 is in excess of 145 million barrels.

Perhaps the next paragraph and small table could be taken as read, because it has been read before.

THE CHAIRMAN: Thank you.

MR. GOVIER: The distribution of the remaining recoverable reserves of oil and condensate by broad gravity ranges is as follows:

<u>Type</u>	<u>Millions of Barrels</u>
Light and Medium Oils	2,893
Heavy Oil	34
Condensate	185
Total	3,112



These reserve figures represent the total of carefully compiled estimates for all individual pools within the Province. Each estimate is based on all available data on reservoir and production characteristics and refers to proven economically recoverable oil. The significance of the reserve estimates is indicated by considering the ratio of the year-end remaining recoverable reserves to annual production. This ratio has changed from 10 years, in 1946, through a figure of some 50 years in 1948 to its present value of approximately 23 years.

In further explanation of the ratio, the present ratio of 23 years means, in effect, that the presently estimated proven reserves are twenty-three times the production last year. Occasionally the figure is referred to as indicating that the reserves will last for a further 23 years. That is a rather misleading use of the figure because, in the first instance, it is surely to be anticipated that the reserves will grow and, in the second instance, it is almost certain that the annual production will grow, so the Board prefers to consider it merely a useful index number rather than an indication of the life of the future reserves.

Continuing with the text: Future reserves of oil and condensate.

An indication of the extent of the potential reserves of recoverable oil underlying Alberta



may be had by considering the volumes of favourable oil containing sediments in Alberta. To this may be assigned an accumulation factor for oil, based on experience in the United States, and assuming that the same degree of oil accumulation will occur in Alberta. A second approach, which can be related to the number of wildcat wells drilled at any given time, is based on the success of wildcat wells and the area of prospective oil and gas lands in Alberta.

In a submission made to "The Royal Commission on Canada's Economic Prospects", in October, 1955, the Board staff estimated that there existed in Alberta some 200,000 square miles of land favourable for the prospecting of oil and gas and that this area contained some 270,000 cubic miles of sediments favourable for the accumulation of oil and gas reserves. By applying a minimum and maximum accumulation factor of 40,000 and 55,000 barrels of oil per cubic mile of sediments to the total volume of favourable sediments a potential reserve figure of 10.8 billion to 14.9 billion barrels of recoverable reserves is calculated for Alberta. These reserve estimates refer to the total gross volumes of recoverable oil with no deduction made for the oil produced during any period.

The second approach employed in estimating the future recoverable reserves of crude oil is based upon the record of success of wildcat wells and the



area of prospective oil and gas lands in the Province. The density of wildcat drilling has increased steadily from one wildcat per 121 square miles (of the 200,000 square miles of potential oil bearing sediments) as of December 31, 1951, to one wildcat well per 49 square miles as at December 31, 1957. The Board considers that this density will increase to about one wildcat per 10 square miles before the increase in the cumulative virgin recoverable reserves of oil and condensate per wildcat well becomes negligible.

Mr. Chairman, that is just a complicated way of saying the Board thinks it will be necessary to drill about one well per 10 square miles to recover all our oil and gas.

This would give a total of some 20,000 wildcat wells for the 200,000 square miles of potential oil area.

Statistical data dealing with the total number of wildcat wells drilled and the recoverable reserves of oil and condensate discovered to December 31, 1957, show that 4,045 wildcat wells have resulted in the discovery of approximately 4 billion barrels of recoverable virgin reserves. This is an overall discovery rate of almost one million barrels of oil for every wildcat well drilled.



I will continue to read the text, but it might be more convenient for the members of the Commission to refer to the Figure.

The trend in the growth of the virgin recoverable reserves of oil and condensate per wildcat dilled is shown in Figure M-1. That is, the line is A-A1 indicates the rate of virgin reserves discovered per year for the number of wildcat wells drilled each year. To illustrate, in 1947 there were 1.6 million barrels of oil discovered for each wildcat well drilled, and that is indicated by the beginning of the dashed line labelled "Annual basis". The change in the year to year success ratio is indicated by the course of the line A-A. . . You will note that the success reaches nearly 2.7 barrels per wildcat well in 1948, but fell to a low of about .6 million barrels per wildcat well in 1951/52, and then rose again to a peak in 1956 of 1.6 million barrels per wildcat well.

The annual plots are based on data given in Table M-1. The line A-A1 ' indicates the rate of the virgin reserves discovered per year for the number of wildcat wells drilled each year. This line is erratic due to its sensitivity to discoveries of large reserves in any one year. The line B-B1 is the relationship of the cumulative recoverable virgin reserves discovered to the cumulative number of



wildcat wells drilled and illustrates an overall discovery rate of approximately one million barrels for each wildcat well drilled.

Looking at the figure you will note that the line B-B1 is much smoother because it is on a cumulative basis, and the year to year variations are more suppressed than those of the line A-A1. You will note also that over a considerable period of years the growth rate has been close to one million barrels per wildcat well -- that is, on a long-term basis.

Perhaps you would now look at Figure M-2, and I will read the appropriate text, and comment upon it.

Figure M-2 illustrates the trend in the growth of cumulative recoverable virgin reserves with the cumulative number of wildcat wells drilled. The data which appears in Figure M-2 are really the same data which appear in Figure M-1, but they are presented in a different form. The line DE is the trend in the growth of virgin recoverable reserves to date. The line DEF is an estimate of the growth trend that is anticipated with the drilling of a total of 20,000 wildcat wells. The change in slope of the curve reflects an expected reduction in the rate of discovery as the remaining undiscovered reserves decrease.

The conclusions of this approach are:

- (1) that the drilling of an estimated 20,000



wildcat wells will ultimately result in the discovery of some 14 billion barrels of recoverable oil condensate; and

- (2) that the extent to which these reserves are known at any time will depend on the total number of wildcat wells drilled at the same point in time.

The next section deals with the trends in the growth of potential production and production of oil and condensate, and use will be made of the Figure M-3. Perhaps you might wish to turn to Figure M-3, and I will read the text and comment on it.

Figure M-3 which is based on data given in Table M-2, illustrates the trends in the growth of the potential production and actual production of oil and condensate in the Province since 1946. For the years prior to 1949 the markets for Alberta oil and condensate were sufficient to absorb the total provincial production capacity. And, you will note on Figure M-3 that prior to 1949 the curves G-G, indicating the potential production, and H-H, indicating actual production, superimpose on one another so that prior to 1949 there was a market for a potential production, and it was marketed.

With the discovery and the rapid development of the Leduc, Redwater and other fields, the provincial production capacity during the period 1949 to 1952 exceeded the requirements of the Western



Canadian markets by a wide margin. That is apparent by the spreading apart of the lines G-G and G-H on the Figure. The construction of pipe lines to Eastern Canada and to the West Coast during the period 1952 and 1953 made Alberta oil available to Ontario, British Columbia and Washington, U.S.A., markets, and thus a larger portion of Alberta's production capacity was utilized. And, in fact, the percentage relationship between the actual and potential production improved. The line J-J1 on the Figure illustrates in percentages the relationship between potential production and actual production or that which was marketed at the time.

In 1954 the annual average daily production amounted to 70 per cent of the provincial productive capacity. That is consistent with the reading on the Figure because if you look at 1954 and at line J-J1 and across to the left to the appropriate scale you will see that some 70 per cent of the potential production was at that time marketed.

Since 1954 the productive capacity has increased with the discovery of new fields at a faster rate than the growth in markets. In 1957 the annual production rate was equal to only 50 per cent of the maximum efficient rate of production of some 756,000 barrels per day.

The line GH-G on Figure M-3 illustrates the growth in potential production from 18,000 barrels



per day in 1946 to 756,000 barrels per day in 1957.

The line GH-H illustrates the growth in actual production from 18,000 barrels per day in 1946 to 376,000 barrels per day in 1957. The line J-J1 illustrates the percentage relationship of the actual production to the potential production for the period 1946 to 1957.

Mr. Chairman, Figure M-4 deals also with trends in the growth of recoverable reserves related to annual production of crude oil and condensate, and if you would look at that Figure I will read the text and make comments.

Figure M-4 which is based on data given in Table M-2 illustrates the trends in the growth of recoverable reserves of oil and condensate in the Province of Alberta. The line K-K1 shows the growth in virgin recoverable reserves from 157 million barrels in 1946 to 3.9 billion barrels in 1957. This figure compares favourably with the figure of 4 billion barrels in 1957 as predicted in the Board's submission to "The Royal Commission on Canada's Economic Prospects", in 1955. The year-end remaining recoverable reserves during the same period increased from 72 million barrels to 3.1 billion barrels and is shown on the graph as line L-L1. The difference between the virgin and remaining recoverable reserves represents cumulative production as of December 31, 1957, of some 812 million



barrels.

The annual production of oil and condensate, illustrated by line M-M1, has increased almost steadily from 7 million barrels in 1946 to 137 million barrels in 1957. In 1957 the rate of production fell below that for 1956. This decline in rate is believed to be temporary in nature and not indicative of a long term trend of a stable or decreasing rate of production.

The line O-O1 illustrates the relationship of annual production to year-end remaining recoverable reserves for the period 1946 to 1957. The annual rate of reserve withdrawal for the past five years has averaged between 4 per cent and 4.5 per cent of the year-end remaining recoverable reserves. In 1957 this rate had dropped to 4.4 per cent as compared to 4.86 per cent in 1956.

I might add that those figures which express the annual rate of production as a percentage of the year-end reserve are really in the nature of reciprocals of the previous figure we mentioned, namely, that the year-end reserves are equivalent to 23 years of production at the year's rate.

The next side heading is: "Trends in the Growth of the Reserves of Natural Gas." Statistical data dealing with the number of wildcat wells drilled, and the initial disposable gas reserves discovered to December 31st, 1957, are



presented in Table M-3. The table indicates that the drilling of 4,045 wildcat wells resulted in the discovery of some 22.2 trillion cubic feet of initial disposable gas reserves. This is an overall discovery rate of 5.5 billion cubic feet of gas for every wildcat well drilled and agrees closely with the corresponding rates established in June, 1953, June, 1955, and September, 1956. These rates were 5.3, 5.4 and 5.6 billion cubic feet of gas per wildcat well respectively.



I would like now to refer to Figure M-5:
Figure M-5 is a plot of the cumulative initial disposable reserves of natural gas by years using the data listed in Table M-3.

Without making detailed reference to the Table, I might say, in Figure M-5 for a good year, for example, say 1944, there appear five different estimates of the virgin or the initial reserves that had been discovered up to that date. These figures have not been discounted for production. In other words, they represent all of the recoverable gas that was estimated to be in the field even before any production was taken. The reason there are five estimates for one year is that the Board and its staff have been making these estimates since 1952 and in Figure M-5 all of the estimates are represented graphically. You will notice that the estimates in the earlier years were, invariably, found to be too low in the later years. The reason for this is: that the estimates made in any one year can, of course, be based only on the data available to that time and while a gas field may have been discovered in that year or even two or three years before it may be another two or three years or even longer than that before that gas discovery is fully evaluated. The Board's policy of estimating established reserves, taking only the gas which is proven plus a small portion



of the gas which is probable, naturally results in conservative figures so that we expect that the reserves estimated as of any one year will be increased some three or four years later with the availability of more data.

You may be surprised in looking at Figure M-5 to see during 1946, for example, that there have been small increases in the reserves discovered prior to 1946 even in the most recent estimates of the Board and its staff. Those increases are due to and best illustrated, I think, by the kind of thing that happened at the Medicine Hat field where the gas field for many years was thought to be pretty well confined to one area and then a discovery was made which extended the field considerably in an easterly direction. So that even a field which may have been discovered as much as twenty-five or thirty, and, in that case, some fifty years ago, may be extended as the result of further drilling.

For comparative purposes the corresponding graphs published in four most recent Board Reports have been included. The curves indicate that a time lag of several years occurs before new discoveries may be fully evaluated. It is apparent that reserves discovered previous to 1953 have been almost completely evaluated, while those discovered subsequent to that time likely will be



assigned a higher value in total when re-examined in the future.

We might now turn to Figure M-6: this figure is analagous to the Figure M-1 which was presented for oil and condensate and , I think, it will be clear if I just read the text.

Figure M-6 is a revision of similar plots contained in previous Board Reports. It shows the initial disposable reserves per wildcat well drilled for the years 1942 to 1957 inclusive. The dashed line "A-A" indicates the ratio of the initial disposable reserves discovered per year to the number of wildcat wells drilled in the same year. It is erratic due to the sensitivity to discoveries of large reserves in any particular year. When the data are plotted on a cumulative basis as indicated by the line "B-B", a definite trend is established. This curve shows that at December 31st, 1957, due to the drilling of 4,045 wildcat wells which resulted in the discovery of 22.2 trillion cubic feet of initial disposable gas reserves, the cumulative rate of discovery was 5.5 billion cubic feet for each wildcat well drilled. Due to the time-lag effect, previously mentioned, the 1953, 1955 and 1956 values have increased from 5.3, 5.4 and 5.6 billion cubic feet per wildcat well drilled to 7.0, 6.8 and 6.0 billion cubic feet per wildcat well respectively.



The Board believes it realistic to assume that for the next few years at least, six billion cubic feet of natural gas reserves will be developed per wildcat well.

You might now turn to Figure M-7: Figure M-7 shows the growth of cumulative initial disposable gas reserves with the cumulative number of wildcat wells drilled. The line DEF is an estimate of the growth trend which was constructed as a conservative forecast on the basis of data available for the Board's November, 1953, report. On the basis of current data the Board is of the opinion that the projection indicated by line ABC is reasonable. The change in slope of the curve indicates an expected diminishing rate of growth of initial disposable reserves of gas per wildcat well drilled in future years from the present expectation of six billion cubic feet per wildcat well. At the present rate of 350 to 400 wildcat wells per year the diminishing rate is not expected to be noticeable until five to ten years hence.

Looking at Figure M-7 you will note when 20,000 wildcat wells are drilled, the original forecast suggested that the reserves would be about 44 trillion cubic feet. The line A, B, C suggests a figure of about 60 trillion cubic feet.

As a check on the projection, a comparison may be made with the estimated future oil reserves,



previously discussed. At December 31st, 1957, the cumulative initial recoverable gas reserves and the cumulative virgin recoverable reserves of oil and condensate were 22.2 trillion cubic feet and four billion barrels respectively. The reserves gas-oil (plus condensate) ratio is 5,500 cubic feet per barrel. Applying this ratio to the range of estimates given for the cumulative virgin recoverable reserves of oil and condensate after the drilling of 20,000 wildcat wells, one obtains the corresponding range of cumulative initial recoverable gas reserves of 60 to 83 trillion cubic feet. The Board believes this alternate approach to the reserves projection to be indicative of ultimate possibilities.

Mr. Chairman, I believe the Tables M-1 through M-3 are self-explanatory but I would be glad to highlight them if you think it would be of use.

THE CHAIRMAN: Speaking for myself, I think I have followed them. However, if any Commissioner wishes the remarks ---

THE COMMISSIONERS: No, no.

THE CHAIRMAN: I think you have done an excellent job.

THE COMMISSIONERS: Hear, hear.

THE CHAIRMAN: You have given us a great deal of hard work, and, I assure you, and I do not really know how to express the appreciation of this



Commission for the amount of work that has gone into the brief of the Conservation Board. Mr. McKinnon, you and your colleagues have presented a most complete brief here and we are very, very grateful, sir, and thank you for all that explanation as you went along. It was very complicated and I think we got as much as can be expected at one sitting. I think, possibly, we should take a break for ten minutes.

---A short recess.



THE CHAIRMAN: Gentlemen, may we resume our hearings now, and I would like to remind you that today we will adjourn for lunch at twelve-fifteen, instead of twelve-thirty, and return at two o'clock.

Mr. Pattillo?

MR. PATTILLO: Thank you, Mr. Chairman. Mr. Chairman, the way in which I hope to conduct this examination is by directing a question to the members of the Board without designating any one to answer the question, and they will decide between themselves which one will answer the question, or whether they wish to refer the question to one of the staff of the Board to give the answer. You will appreciate, gentlemen, that these questions in large measure are going to be directed to seeking explanations to amplify or further develop what appears in the brief.

BY MR. PATTILLO:

Q. I would first direct your attention to the preface of the brief itself and the statement contained in the last sentence of the first paragraph, which reads: "The Board is not concerned with the refining of oil and deals only incidentally with the transportation and removal from the Province of oil." Would you please amplify that and explain the significance of the statement?

MR. MCKINNON: Mr. Pattillo, the Board regulates the drilling and production activities in



the Province. It sets the allowables for oil and gas but it has nothing to do with the operations of any refinery in the Province. As far as transportation is concerned, the Pipe Line Act is administered by the Department of Mines and Minerals, but the Board does act in an advisory capacity to the Minister. The Board sees that oil which is produced is not wasted and that it is transported within the Province without loss. In other words, its jurisdiction terminates with the storage tanks in the field. I think as mentioned in the brief, the Board can declare any provincial pipe line to be a common carrier.

Q. Has it ever exercised that jurisdiction?

MR. McKINNON: No, we have not.

Q. There has never been any application coming before the Board by any persons seeking to have any pipe line declared a common carrier?

MR. McKINNON: No.

Q. And does the Board in any way concern itself with the price of oil at the wellhead?

MR. McKINNON: No, sir.

Q. Or the rates charged for the transportation of oil through pipe lines?

MR. McKINNON: No. If the Board declares a pipe line to be a common carrier, then the transportation rates would automatically be decided by the Board of Public Utility Commissioners of the



Province.

Q. But so far that has never arisen?

MR. McKINNON: Not in connection with oil lines.

Q. On page 5, in the last sentence of the first paragraph: "Permeability usually is measured in millidarcies and the permeability of oil and gas reservoir rocks is found generally to vary from well under 50 to over 1,000 millidarcies." Both Dr. Hardy and myself are completely ignorant as to what a millidarcy is.

MR. GOVIER: Mr. Chairman, I am very surprised at Dr. Hardy. Mr. Pattillo, the darcy is the fundamental unit of permeability. A millidarcy is $1/1000$ th of it. The darcy was proposed and accepted as a unit of permeability after the work done by a famous French physicist by the name of Darcy, and the darcy is defined in this way: a permeable formation of rock is said to have a permeability of one darcy if it will permit the flow through a one square centimeter portion of it at the rate of one cubic centimeter per second of a one centipoise fluid under a pressure gradient of one standard atmosphere per square centimeter.

For Dr. Hardy's information, that means it would permit the flow of one cubic centimeter per second of water through one square centimeter under a driving action of one atmosphere per



centimeter.

THE CHAIRMAN: I am sure Dr. Hardy understands.

MR. PATTILLO: Q. At page 9, in the middle of the first paragraph, there appear in brackets the words: "in the case of a flowing well." Would you please explain what you mean by a flowing well?

MR. GOVIER: A flowing well is one from which the production of oil or gas comes to the surface without the aid of mechanical lifting equipment. In other words, it is a well that does not have to be pumped.

Q. At the bottom of the same page, page 9, the sentence appears: "The water drive mechanism is aided by gravitational segregation and is efficient only when the rate of advance of the water front is extremely slow." What would happen if the rate of advance of the water front was not extremely slow?

MR. GOVIER: What would happen under that condition is this, that the water in extending toward the region of pressure release, which is the well bore, would flow through the paths of least resistance and could very easily flow in an erratic manner, isolating certain channels of crude oil and making them virtually non-recoverable. The explanation in the text makes reference to the importance of gravitational segregation. That is simply, in other words, saying that the process has



to be fairly slow so that the oil and water will have an opportunity to maintain their proper relative positions, with the water beneath the oil and the oil above the water. If the rate of advance is too rapid, the pressure differential could easily cause the water to encroach into the oil and, as I mentioned before, could isolate blocks of oil from the well bore.

Q. In the same paragraph, in the last sentence: "Experience in the operation of water drive oil fields, coupled with laboratory tests and theory, tells us that under ideal conditions recoveries as high as some 80 per cent of the oil in the reservoir might be expected." Would you please give us your view as to what are the ideal conditions required?

MR. GOVIER: I will do my best, sir. I would consider the following conditions to be important to a high recovery of oil from a water drive field: first of all, uniformity of reservoir conditions is extremely important because only when the reservoir is relatively uniform will the advance of the water front also be uniform.

Secondly, good porosity and good permeability are important.

Thirdly, a controlled rate of withdrawal which will permit gravitational segregation to take place is of utmost importance.



Fourthly, of course, it follows that there must be a source of energy for the water drive, and that means that there must be a very large body of underlying water in pressure communication with the oil reserve.

There are many other points, but I think perhaps those four are the chief ones.

Q. Thank you. On page 11 the sentence appears, opening the first complete paragraph, "The solution gas drive is not an efficient displacement process." Why is that so?

MR. GOVIER: The reason for that is that the displacing action which takes place in a solution gas drive is one whereby small bubbles of gas evolved from the oil by pressure reduction move toward the point of pressure release, which is the well bore, and they push along with them, in a rather inefficient way, some of the oil. That process can continue only so long as there is gas which can come out of solution, and after a certain amount of production most of the gas may have been already produced. At that time there is no further solution gas to do any more pushing, even on an inefficient basis.

Q. At the bottom of the same page:
"The gas cap mechanism, like the water drive, is a rate-sensitive process and high efficiencies result only when the rate of expansion of the gas



cap and the downward movement of the gas-oil interface is kept low." Does the same explanation you have given to us about the water drive apply to the gas cap?

MR. GOVIER: Yes, it does, sir.



Q. On page 12, at the bottom of the page, there is a phrase, "truncated by erosional forces."

Would you please explain that?

MR. GOODALL: I guess I had better take the ball from here. "Truncated," of course, means cut, and we have sedimentary deposits which were originally laid down in a horizontal position and, later, tilted. Erosional forces will cut across the various formations. By "erosional forces" we mean ordinary erosion of wind, water, ice and so on, such as is going on all over the world at the present time, but, numerous times during geological history, there were long periods in which the land surface was above the ocean floor and a lot of the sediments were removed by erosion.

Q. Well, Doctor, would what you are saying be illustrated if you had a V upside down and you cut off the top of it?

MR. GOODALL: I think, probably, I could illustrate it pretty well with the leaves of a book. Say these leaves are inclined and you take a sharp knife and cut it off horizontally.

Q. Thank you. On page 13, at the bottom of the page, the statement is made:

"To date approximately 27 per cent of
"the recoverable oil reserves and 41
"per cent of the disposable gas reserves
"of Alberta have been discovered within



"the conglomerate and sandstone reser-
"voirs contained by formations of Cre-
"taceous age. The remaining reserves
"have been found nearly entirely in the
"limestone and dolomite reservoirs of
"the underlying formations of Mississip-
"pian and Devonian age."

In the light of those statements and the information you gave us yesterday as to the thickness of the sediment, starting from zero up in the northeast corner and becoming thicker towards the southwest corner and the foothills, is there any significance as to where -- and there is some other mention somewhere as to recent work, having been largely along the western part of the Province -- is there any significance as to where one might anticipate the greater part of the exploratory and discovery work will be carried out in future?

MR. GOODALL: I think, as we mentioned in the text, there has been a greater concentration of wildcat drilling in the thinner sediments of the plains of Alberta, the main reason for this being that drilling is much cheaper, you can explore a larger area with the same amount of capital expenditure; but, as new finds become less or not so frequently discovered, oilmen start looking to the more expensive part of the Province for prospecting, and a large part of our previous wildcat



drilling on the plains was in search of the reef deposits of the Devonian.

Now that they are starting to look for these deep-seated gas deposits, they have to go into the foothills, where the drilling is much more expensive and it becomes more difficult; the reservoirs are much harder to locate with geophysical methods.

Does that answer your question?

Q. I think that does, Doctor, thank you.

MR. GOODALL: I am not a doctor.

Q. On page 18, reference is made, in the first paragraph, to a legal subdivision. As I understand it, in the Province of Alberta that is 40 acres, is that right?

MR. GOODALL: That is right.

Q. What is the significance of the 5th meridian being a division line so that you say, "The normal oil well spacing unit west of the 5th Meridian is two legal subdivisions"?

MR. GOODALL: The 5th meridian was chosen because it seemed to come in a natural break in the Province with regard to the development. Wells west of the 5th meridian were getting into the deeper and more expensive drilling and, when this regulation was brought into effect, all of the drilling on the western side of the 5th meridian had been carried out on spacing of two legal subdivisions or



greater, and the Board considered that the 5th meridian was a convenient and proper place.

Q. Now, at the bottom of the same page:

"If a well is completed outside its target area, the area upon which its production allowable is based will be an area less than that of the spacing unit and determined in accordance with the regulations or the spacing unit order."

Would you please explain and amplify that?

MR. GOODALL: Probably I should explain first what a target area is. In a normal spacing unit of 40 acres or one legal subdivision, the central square area of dimensions of 330 feet, with its boundaries parallel to the boundaries of the legal subdivision, is considered a target area in which you can set up a rig and drill anywhere within that 330-foot square.

That allows the operator a little leeway as regards surface topography and other conditions which he might run into in any location.

The target area expands in size with depth. This was to permit wells to deviate from the vertical on being drilled and not go outside of the target area, providing they deviated within reasonable limits.

The target area increases at a rate of 4 feet per 100 feet of depth, to a maximum limit of



660 feet dimension.

Now, if it is necessary or an operator considers it necessary to drill his well outside of the target area, that means he is encroaching on his neighbour; he is getting close to the edge of his spacing unit, and the withdrawal rates over the reservoir will not be as uniform as if he drilled each well in the centre of the legal subdivision or spacing unit.

So, for that reason, a penalty is applied for any well outside of the target area.

Q. Now, at the top of page 19, I am interested in the first two sentences:

"The Board has issued orders creating
"spacing units other than normal spacing
"units in a number of fields and areas
"throughout the Province."

Does the Board do that on its own initiative or on application of your companies?

MR. GOODALL: The Board does that on application of a company.

Q. And the next sentence:

"The Board believes, with industry, that
"the trend toward wider spacing generally
"is sound, and most abnormal units are
"larger than those that would apply in
"the absence of a spacing unit order."

Now, is that decision of the Board and industry based



on experience in the Province or experience elsewhere?

MR. GOODALL: Generally, it is set up as a temporary order until the field has been evaluated and the reservoir conditions are better known. The Board issues many of its orders for a one-year period and, by the end of the year, if it is found that the wells can adequately drain the area and there will be no waste, then a permanent order is issued.

Q. Now, at the bottom of page 23, in listing the requirements of the Board, the last line, one of the requirements is:

"All gas wells must be adequately tested
"by the back pressure method either
"shortly before or shortly after going
"on steady production."

Would you please explain what is the back pressure method?

MR. GOODALL: The back pressure method involves the flowing of a well at various pressure rates.

Q. Is that a new development or is that something that has been known to industry ---

MR. GOODALL: That is not new. It has been employed for many years by industry. It conserves some gas and is less likely to damage the well than the method of flowing while wide open to determine its rate.



Q. At the top of page 25:

"Crude oil samples are analyzed by the

"United States Bureau of Mines method."

What is that method?

MR. GOODALL: I will let the chemist answer that.

MR. GOVIER: I would be glad to comment on that, Mr. Pattillo. It is a method that was developed by the United States Bureau of Mines during the years and it involves certain simple and routine tests on crude oil, such as the determination of its density or gravity, the determination of its sulphur content but, most important, it involves a distillation of the crude oil by a standardized method and in standardized apparatus. It also involves the reporting of the results of the distillation in a standardized fashion to facilitate comparison of the properties of crude oils all over this continent.

Q. Now, Doctor, would you just explain the next paragraph? I cannot even pronounce that word but would you tell me what that unit is and what it does?



H MR. GOVIER: There are two types of apparatus that are commonly used today for making a hydrocarbon analysis of natural gas. One of these is a device which involves the liquefaction of the natural gas and its subsequent distillation. The equipment manufactured by the Podbielniak Company under the name of Hyd-Robot is a pretty well automatic apparatus for carrying out that kind of analysis. The University of Alberta owns such an apparatus, and the Conservation Board has the use of it for carrying out gas analysis.

A more recent development in the analysis of gas is the so-called chromatographic method. This is a method whereby a sample of the gas is passed through a tube which contains a certain selective type of solid material, and by a process of selective absorption of the various components by the solid material and the subsequent release of these components from the solid material the analysis of the gas may be obtained. The Board is now making almost exclusive use of the more modern equipment, the Kromatog.

Q. At the bottom of page 25 you make a distinction between the reports of analyses on designated fields -- wells within designated fields -- and samples taken from wells outside of such fields. I assume that the reason for that is that a person who has made what may be a wildcat



discovery is protected in that manner so that he has an opportunity to advance his discovery without its becoming known to the public?

MR. GOODALL: That is right, Mr. Pattillo. The designated fields are declared to the Board after about three wells have been in production, and it is considered then that the information obtained from them should be released for general use.

Q. On page 27 at about the middle of the page this sentence appears:

"Underground waste occurs if recoverable
"oil is permitted to migrate to another
"formation from which it cannot be re-
"covered."

I was puzzled as to how it did migrate, when it had low, or relatively no, energy of itself to move.

MR. GOVIER: The danger there is that the pressure in different strata is different, and, generally speaking, the pressure in underground strata increases with depth, so that if oil contained in one strata were allowed to be in communication with a strata at a lesser depth there is the definite possibility of the oil's migrating from the point of high pressure to the point of low pressure. The driving force, or the reason for flowing, would then be the difference in pressure.

Now, that can also happen -- that is, this kind of migration can also take place between the



strata where shut-in pressures may be relatively the same but where the pressure in one strata can be considerably reduced by production from it, and then, again, a pressure differential can be created.

Mr. Goodall may wish to add something further to that.

MR. GOODALL: I think that is sufficient.

Q. Now, on page 28: As I understand it, the MPR and the MER, after some period of experience, should become one and the same; is that correct?

MR. GOVIER: That is right, and when that time arrives the Board discontinues reference to MPR completely.

Q. Well, now, when you say in this paragraph:

"The MER of a well or pool is that maxi-

"mum rate at which production may be

"taken consistent with sound economics..."

does the question of markets enter into it at all?

MR. GOVIER: No, sir, it does not. The MER of a reservoir or well is the maximum efficient rate at which that well can be produced assuming there were an unlimited market.

Q. Now, later in the page you say:

"The MPR formula was developed by the

"Board to enable it to set allowables



"for wells on an equitable basis and on
"sound engineering grounds early in the
"life of a pool."

Now, why should the question of equity enter into
the determination of an MPR?

MR. McKINNON: One reason, Mr. Pattillo,
why it became very important that we treat our pools
on an equitable basis was that when it became neces-
sary to pro-rate to market demand the MPR formula
was used in allocating the provincial allowable.
I think it is explained in the text that each well
in the Province is given an economic allowance, and
that the residual demand is then allocated between
fields, pools and wells on the basis of the MER or
MPR of the various pools. When it became apparent
that some kind of pro-ration was going to be entered
into, we realized it was very important in
setting the MPR of the pools throughout the Province
that we do it on the same basis.

MR. PATTILLO: Therefore, the MPR when
it is originally set is something quite different
from the MER that ultimately comes into the picture?

MR. McKINNON: We use certain data in
computing the MPR, but when we get all the exper-
ience we need to set up the MER we use the MER, but
it was essential that there be some formula to be
used as soon as the pool was discovered to deter-
mine its MPR, and that the MPR be on an equitable



basis.

MR. GOVIER: Mr. Pattillo, I might add this comment, that even assuming conditions of unlimited market equity considerations are still important, and you will recall that in the intent clause of the Oil and Gas Conservation Act there is reference to the affording to each owner the opportunity of recovering his just and equitable share of the production of any pool, so that even under hypothetical conditions of an unlimited market it is important that the MPR formula represents equitable rates of withdrawal for various wells within a single pool.

Q. Thank you. On page 30 -- and you may have cleared this up this morning in your explanation, but I would like to direct your attention to this remark:

"In 1949 the market demand for Alberta
"crude oil fell below the level of pro-
"duction obtainable under the maximum
"producing rates then established.
"There followed several months during
"which production from various produ-
"cing pools was prorated to the exist-
"ing market on the basis of pipeline
"acceptances. Early in 1950, a number
"of producers requested that the Board
"establish an equitable system of pro-



"ration to market demand."

The question I would like to ask about that is:
Am I correct in thinking that the reason for the
change in 1949 was the increased discoveries that
had been made at that time, and that there was more
oil available than you had a market for for the
first time?

MR. GOVIER: Yes, sir, that is right.

Q. Now, coming to the next question:
What was the difference between the prorating on the
basis of pipeline acceptances and the prorating on
the basis of market demand? Were they not one and
the same?

MR. GOVIER: Mr. Pattillo, I can see now
that the text here is, perhaps, a little misleading.
The second sentence in this paragraph almost suggests
that the Board prorated oil on the basis of pipeline
acceptances. That is not correct. There was no
formula of proration during this initial period of
several months, and what we intended by this sentence
was merely to indicate that the sharing of the mar-
ket as between the producers was done on the basis
of arrangements worked out primarily between the pro-
ducers and the operators of the pipelines. It was,
if you like, a completely voluntary industry scheme.
However, it had a great many difficulties, and be-
cause of those difficulties early in 1950 some of
the producers requested the Board to institute a



formula scheme of proration. Does that clear the matter up, sir?

Q. Yes, thank you.

MR. GOVIER: I think Mr. McKinnon would like to add something. Maybe I have misstated it.

MR. MCKINNON: I merely want to elaborate. It was not the pipeline operators that determined how much oil was to be produced, but rather the crude oil producers, and this term "pipeline acceptances" is used sometimes in place of the words "crude oil producers". Where the trouble arose was when one producer might have a bigger demand than another producer, and consequently he was able to take more from the wells he had constructed, and, therefore, there was that equitable formula developed.

Q. I see. On page 36 there is this:
"Present practice in Turner Valley is to
"permit production of gas cap gas in
"accordance with the Brown plan and for
"removal of liquid hydrocarbons and
"effective use of the residue gas."

Now, will you please explain what the Brown plan is, and why it is permitted in Turner Valley in the light of the other comments which you made as to the inadvisability of taking off gas cap gas until the oil had been first exhausted?

MR. GOVIER: Yes, sir. The Brown plan is a plan that was instituted by the Board in the



early days after an exhaustive analysis of the reservoir behaviour of the Turner Valley field. It was made by the late Dr. George Granger Brown who, at that time, was at the University of Michigan. Dr. Brown made a thorough study of the problem and he recognized, of course, that it would be in the interests of the conservation of reservoir energy and the ultimate recovery of crude oil to curtail all production from the gas cap, but inasmuch as discovery wells of that field were wells drilled into the gas cap, and a great deal of gas had already been produced, and the owners of those wells most assuredly had some rights to produce, what would now be considered to be a compromise kind of plan was developed.



The plan, in essence, gave each well owner the right to produce a certain quantity of reservoir fluid. The quantity of reservoir fluid was 25 barrels per acre per day of reservoir fluid. I stress the fact that this was barrels of reservoir fluid because you will recognize in the case of those wells which were actually tapping fluid, the reservoir fluid would be oil, and in the case of other wells which were tapping gas, the reservoir fluid would be gas. The equity considerations were provided for allocating an equivalent amount of reservoir fluid to each well per acre of lands within the well spacing unit. These 25 barrels of reservoir fluid can be converted to a corresponding amount of gas and of oil. The correspondence differs for each well in the field and is calculated on the basis of the immediately preceding history of the well and on the basis of the most recent pressure measurements of the well.

This Brown plan is still in effect and the orders issued on Turner Valley express the 25 barrels per day of reservoir fluid as a certain kind of equivalent of gas.

I am not sure, Mr. Pattillo, whether that explanation has covered both parts of your question or not. Has it?

Q. I think it has. On page 37 you use the phrase, sub-paragraph (b) of 3, "Retrograde



condensation". What do you mean by that?

MR. GOVIER: It would be most unfair of me to ask Mr. Craig or Mr. Stabback to take over at this point, so I will answer and ask them to elaborate, if they wish.

Most ordinary hydrocarbon mixtures condense if the temperature is lowered sufficiently or if the temperature increases sufficiently. That is, to illustrate, propane is gaseous under certain conditions. If the temperature is lowered propane will condense or liquefy or if the pressure is increased propane will condense or liquefy. There are, however, some mixtures of hydrocarbons which undergo a reverse phenomena. That is, these mixtures which may appear gaseous at one pressure of temperature can, actually, partially liquefy to a reduction of pressure which is the reverse of what one would intuitively expect, and this reverse phenomena is what is known as retrograde condensation. It takes place only with mixtures, and only with mixtures that are at rather high pressures and corresponding temperatures.

Typical mixtures of this kind are, well -- the fluid content in the Pincher Creek field is the kind of fluid which undergoes retrograde condensation under certain conditions.

In that instance, a study made a number of years ago indicated that while there might be some



retrograde condensation occur, it is not too serious. But that is the kind of mixture that undergoes this phenomena. I might just go a little further, Mr. Pattillo, to indicate the significance of the phenomenon with which we are dealing. The phenomenon is important for this reason: it is conceivable that one might have an underground reservoir containing a hydrocarbon mixture at high pressure and corresponding temperature, and one might start production from that reservoir which would result in a pressure decline and attending that pressure decline there might be a literal precipitation of liquid of retrograde condensation in the reservoir pores. That precipitated liquid in the reservoir pores would be held by capillary forces to the rock and it would, in large measure, not be recoverable.

Q. Even though you increase the pressure again?

MR. GOVIER: Mr. Pattillo, I can see that you understand this very well. You are quite right: if one were to increase the pressure and one were to wait for a sufficient length of time to re-establish the equilibrium condition, the precipitation condensate would evaporate and it might even be recovered by a cycling process. Ordinarily, one would not permit the establishment, under pressure, of a reservoir if it were going to be necessary to increase the pressure at a later date.



Q. Now, at the top of page 44 this sentence appears: "Such augmentation of reservoir energy, now a well-recognized recovery-improving technique in the industry, is still often referred to as 'secondary recovery', although its original connotation has been lost." What I am not clear about there is this: supposing I have discovered ore and I have a well that is not a flowing well; I must pump it. Do I pump and get all the oil that I can without starting any secondary measures until such time as I no longer can get oil, or do I start my secondary measures immediately?

MR. GOVIER: The current trend is to introduce the recovery stimulation process at quite an early stage in the operation of a pool. I would like to emphasize, however, the fact that a well may require pumping should not be considered as an indication that secondary recovery or recovery stimulation is needed. Many highly efficient fields are pumped. Where the energy problem is most critical in an oil reservoir is in the formation itself. So long as the oil will flow to the well bore, it is not really a serious matter if you have to put in mechanical equipment to lift it up to the well. I got the impression from your question that you almost had the idea that if a well had to be pumped, it was a bad thing and one



should avoid it at all costs.

Q. I realize it is not and I should have framed the question in another way. What I was trying to bring out was whether recovery stimulation was commenced earlier, or whether it was only commenced at a later stage when the forces of nature or pumping were no longer being sufficiently effective.

MR. GOVIER: The critical thing is to get a preliminary understanding of the mechanical needs. With that understanding there is a situation where recovery can be deferred with no loss, and there are other cases where it should be introduced very early in the life of the well.

Q. On page 47 you are dealing with recovery stimulation, the last paragraph: "Of particular interest at the present time is some of the experimental work being carried out in the use of liquefiable petroleum gases, such as propane or butane, as injection fluids, (miscible flood). Laboratory experiments suggest that extremely high recoveries may be realized through the use of such fluids." Have not such fluids been used elsewhere on the continent with quite good success?

MR. GOVIER: Yes, sir; although it is a very recent development and I do not know of any reservoir which has, so far, been completely depleted with the aid of miscible flood process.



Q. I think I will just finish this chapter before we adjourn for lunch. The last sentence on page 49: you are saying: "... where the water and excess gas that is produced with oil is being returned to the pool from which it is produced. While such schemes are not thought of as recovery stimulation projects but rather as gas conservation or water disposal schemes, they are in fact beneficial to a small degree." Why do you qualify it in saying they are only beneficial to a small degree?

MR. GOVIER: I think that might be illustrated by reference to the Redwater field. In the Redwater oilfield a fair amount of water is produced, unavoidably, with the oil. There is a complete pipeline grid system which gathers this water from all batteries and takes it to a central point from which, after certain processing, it is then reinjected into the water which underlies the actual accumulation in the pool. This, in effect, could be considered an artificial reservoir energy system project, but the fact of the matter is that the additional or the return of the water does not appear, on the basis of present knowledge, to be absolutely vital to oil recovery. On the other hand, it is a very convenient place to put the water and the return of the water in that reservoir, probably, does some good from a reservoir energy stimu-



lation process but it is, primarily, a water disposal scheme.

Q. Are you differentiating the purposes for which it is done as opposed to the result that is achieved?

MR. GOVIER: I am, indeed, Mr. Pattillo; and also because there is a difference in purpose, there is a difference in force of water; in this case, a quantity of water.

MR. PATTILLO: I suggest, Mr. Chairman, we adjourn until 2.00 o'clock.

THE CHAIRMAN: The hearing is adjourned until 2.00 o'clock this afternoon.

---Whereupon the hearing adjourned at 12.30 P.M.
until 2.00 P.M.

- - -



---On resuming at 2.00 p.m.

THE CHAIRMAN: Gentlemen, we will now resume the hearing. Mr. Pattillo?

MR. PATTILLO: Thank you, Mr. Chairman.

Q. Gentlemen of the Board, may I direct your attention to page 51 of the brief where you are discussing unit operation, and this sentence, commencing the third line from the bottom, appears: "While unit operation is generally accepted as desirable in a proper case, it met considerable opposition in earlier years with the principal objection being that it tended to eliminate the smaller operators from field operations." How did it tend to do so?

MR. McKINNON: Generally speaking, Mr. Pattillo, the major operator in a field would be nominated as the operator to conduct operations under the unit agreement. It would, therefore, eliminate the smaller operators from anything to do with the operation of wells or the operation of the unit to the extent -- and I don't say I agree with this theory -- it has been said by various people that by having too many unit operations you destroy the initiative of the small operators. In other words, the small operator may have some different ideas from the operator of a pool in respect of well completions and in respect, possibly, of any secondary



operations that may be decided upon. It would mean, possibly, in the case of smaller companies, that they would not be able to maintain an engineering staff, or, if so, that it would be considerably curtailed.

Q. In the case of the unit operations that do exist in the Province of Alberta has, if I might borrow an insurance term, the lead company always been the unit operator?

MR. McKINNON: Pretty well, I would say.

Q. On page 53, the last paragraph: "The Act stipulates that a compulsory unit operation order shall not come into effect until it has the consent of the owners of the drilling and producing rights in 75 per cent of the unit area and the consent of the owners of the head lessor's royalty interests in 75 per cent of the unit area." As I understood this morning, unit operations have not been initiated by the Board itself, but as a result of application by some member of the industry; is that right?

MR. McKINNON: Where operators in a field have agreed, themselves, to conduct unit operations, they have come to the Board for approval. As we state here, the compulsory features of the Act have not yet been ---

Q. They have never been invoked.
On page 55, the first complete paragraph,



you say: "Natural gas and its by-products apparently are being used as chemical raw materials in five large plants in the Province." Would you tell us where those plants are geographically located?

MR. McKINNON: In Edmonton there is Canadian Industries Limited who are manufacturing polyethylene. There is Canadian Chemicals Limited who are producing a cellulose acetate fibre, and in Calgary there is Consolidated Mining & Smelting Limited producing ammonium based fertilizers. There is the Sherritt Gordon plant in Edmonton which is producing ammonium sulphate as a by-product, and the gas itself is being used in the leaching process in the refining operation.

Q. Have all of these plants come into existence in very recent years?

MR. McKINNON: Yes; there was one additional fertilizer plant in Medicine Hat, North West Nitro Chemicals Limited.

Q. The addition of those large plants would make quite a change in the volume of natural gas being used in the Province itself?

MR. McKINNON: Yes, they use a considerable amount of gas for fuel purposes besides the by-products and raw materials.

Q. I had observed in looking over one of the appendices that not only did your



figures as to reserves of the gas go up each time, but your figures as to the quantities of gas that you estimate will be required for use in the Province have been radically advanced upward too?

MR. McKINNON: That is quite right.

Q. And I suppose in looking ahead as to what might be needed for gas in the Province, one is confronted with the difficulty of not knowing what industries or how many industries might decide to locate in the Province?

MR. McKINNON: That is correct.

Q. How do you take that into consideration? I mean, in trying to make an estimate of a 30-year projection into the future as to the gas reserves that would be required for the Province, how do you allow for those industries that have not yet decided to come, or may not even be in being?

MR. McKINNON: Mr. Cooper could probably fill in the details that I omit, he has been responsible for preparing the Board's estimate of requirements. When we originally started out to prepare the estimates we looked at experience figures in Texas, Kansas and other States where they had available large gas reserves. We looked first of all at the per capita consumption on a domestic basis in those States, the per capita consumption on a commercial basis and the per



capita consumption on an industrial basis.

Q. Just, may I ask you one question about that: in looking at those figures that you have just told us about do you look at them in comparative years? In other words, Alberta has had quantities of natural gas for so many years, and had a population curve at that time of such and such a curve: do you compare that with similar situations and what has occurred in a State like Texas or California?

MR. McKINNON: Yes, we did. We considered what might be the relative development in Texas and the development in Alberta.

Q. Yes?

MR. McKINNON: And, if my memory serves me correctly, we thought we might be about ten years behind Texas when we started off first in using the basic figures we obtained from their consumption. We also compared that with the consumption figures based on experience here in Alberta; that is, the experience of North West Natural Gas at Edmonton and the Canadian Western Natural Gas in Calgary. We also used other experience figures for other utilities in the Province. Then we took a pretty good look at all that data and came up with certain per capita figures for domestic and commercial use in the Province, and for industrial use. We extrapolated those figures when we first started in 1952, to 1960; we extrapolated them with estimates for increased



population. The figures on the extrapolation -- we increased the per capita consumption in each of the three categories until 1960, besides dealing with the increase in population, and from 1960 on, we might say, stabilized those figures and then converted the requirements by using the population from 1960 on with the per capita figures for domestic, commercial and industrial that we have arrived at at the 1960 period. Do you have anything to add to that, Mr. Cooper?

MR. COOPER: I think the explanation Mr. McKinnon has given pretty well exactly follows in complete detail what we did. However, I might make one additional point, and that is, when we looked at the industrial requirements we actually obtained information from all the various industrial plants, and the present and anticipated use, and related what we were able to get on that basis with present and possible revised projections for future per capita rates on an industrial basis. In other words, they served as a guide to, possibly, where we did establish a saturation level on a per capita basis for industrial use.

MR. PATTILLO: Thank you, Mr. Cooper.

Q. On page 57 you have this statement: "It has been suggested in these cases . . ." -- and you are talking about the delivery of gas to communities within the Province -- ". . . that the communities would do better to wait on the chance that further drilling or the construction of additional gas transmission lines



would provide gas at a lower cost. A waiting period already has benefited some communities." What I am concerned about there is, I can appreciate that the construction of transmission lines, particularly if they run near to a community, would necessarily lower the cost of obtaining gas, but if you were permitting large quantities of gas to be exported from the Province, and you have people as a consequence bidding for the gas, are you not inevitably going to drive up the price of gas and have a higher cost gas being delivered to the communities?

MR. McKINNON: It is possibly true, but in many cases the cost of the gas at the wellhead is a small percentage of the price charged to a consumer at his burner tip.

Q. May I ask you to turn to page 59, where you are dealing with the question of removal of gas from the Province, and the statement is made: "The Act prohibits the granting of a permit unless the Board is of the opinion that it is in the public interest to do so . . .". In reading this material it seemed to me that your Board was translating that phrase to really mean that unless it was detrimental to the people in the Province of Alberta, because it might affect their future supply of gas: am I correct in thinking that is the translation you have been putting on that phrase?

MR. McKINNON: I am sorry, I didn't quite



follow you.

Q. The phrase is: "The Act prohibits the granting of a permit unless the Board is of the opinion that it is in the public interest to do so...". I am suggesting that from reading all the material it seemed to me that the Board had translated, in determining whether or not to export gas was in the public interest, you were seeking to find out whether it was in any way detrimental to the consuming public of Alberta for the next thirty years to permit the gas to go out, and that was as far as your inquiry went?

MR. McKINNON: Yes, I would say that is so.



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Q. And again, in interpreting that phrase, you do not have any regard as to whether or not the producing portion of the public in Alberta is or is not getting a provident price for its gas?

MR. McKINNON: The Board has nothing to do with the price of gas, Mr. Pattillo.

Q. Now, on page 60 you say, "The terms and conditions of a permit may stipulate --" -- and I am omitting some things -- "-- conditions under which removal may be diverted, reduced or interrupted."

Now, would you please explain that and explain to us under what conditions you do set up whereby you may divert, reduce or interrupt gas going out of the Province?

MR. McKINNON: In the Act itself there is an emergency clause whereby the Board can, during the life of an emergency, divert gas that would otherwise be exported to Provincial use, but that would not include gas being exported for domestic use.

In other words, we can divert only the industrial gas.

Q. Well, what I was curious about is this: supposing the Board had granted a permit, as in the case of Westcoast Transmission, to export gas from the Province to the United States and, as



a result, Westcoast entered into a long-term contract with the United States company to supply it with gas and, in addition to your Board's export permit, it had obtained an export permit from the Federal Government at Ottawa. Is it contemplated that your Board, at any time during the life of that contract, if it deemed it desirable to do so, could divert, reduce or interrupt the gas that Westcoast was delivering to the United States?

MR. McKINNON: Yes. I might say we are very careful in the export carriers to the point set out and I would refer you to Section 10 of The Gas Resources Preservation Act.

Q. Has there been any reference to the courts to determine whether or not that is within the powers of the Province?

MR. McKINNON: Not that I know of. Clause (b) of that section applies. There is another thing I might mention, that, for instance, in the Westcoast permit, that was issued originally, they are permitted to take gas in certain fields in the Peace River area, but on the condition, with respect to certain fields, that enough gas must be left in there to supply communities in the area.

Besides that, there is a general provision in each permit issued that any company gathering gas for export must make gas available to any person in the Province that is willing to take delivery of



gas at such reasonable price from a point on the company's pipeline and that, in the opinion of the Board, can reasonably be supplied by the company's line.

Q. I direct your attention to page 62. There you enumerated evidential material that you require to be submitted before the Board on any application for an export permit from the Province, and the first one says, "Evidence that at least 80% of the gas proposed to be removed is under contract to the applicant and particulars of each of the gas purchase contracts."

Now, when you require that information, are you only requiring information as to the peak loads, including the interruptible gas that has been contracted for; or are you inquiring into firm loads that are contracted for, or what are you seeking when you are talking about this 80 per cent.?

MR. McKINNON: That the applicant must have at least 80 per cent. of the gas which he proposes to export under the contract.

Q. That would include peak load requirements?

MR. McKINNON: It would simply be the gas that he proposes to use. Now, the rates at which he used that would be a matter of the contract from a deliverability point of view. You have so much gas contracted for at an annual rate specified,



possibly, and possibly a peak specified.

Q. You merely seek to inquire as to whether he has contracts with purchasers to cover up 80 per cent. of those requirements?

MR. McKINNON: Yes. One reason for that is to allow the purchasers to do their own bargaining as far as any disposition of their gas is concerned.

Q. The evidence under Paragraph 6 that the proposed removal of gas is in the public interest, that is in the line I have already addressed to you?

MR. McKINNON: That's right; protecting the people of the Province.

Q. Now, I put to you Paragraph 7, at the top of page 63: "The route and design details and capital and operating costs of the pipeline facilities."

Do you inquire into the capital cost of the construction of the pipeline and the proposed operating costs?

MR. McKINNON: Yes.

Q. You do. Then we come to Paragraph 8, "Cost with respect to the marketing areas to be served beyond the Province and the amounts of gas to be used for domestic, commercial and industrial purposes."

May I ask you: what is the purpose of the



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inquiry into the amounts of gas to be used for domestic, commercial and industrial purposes?

MR. McKINNON: For the purposes of Section 10 of The Gas Resources Preservation Act, which is the emergency section I referred to previously.

Q. And when you use the words, "cost with respect to the marketing areas to be served," what are you seeking to find out there? How much a distributor is going to pay at the gate of the transmission line, or what?

MR. McKINNON: Mr. Pattillo, there is an error there. It should be "details", because the cost particulars are asked for.

Q. So that word "cost" in Paragraph 8 should read "detail"?

MR. McKINNON: That's right.

Q. What are the details you have asked for?

MR. McKINNON: Well, we would ask, as it says here, the amount of gas to be used for domestic, commercial and industrial purposes. The reason is that we can divert industrial gas but not domestic and commercial gas. It also enables us to determine what the load factor of the operation is for general information purposes.

I might say that a company might be entering into a new market and they prepare a marketing study, and when that is so the market study usually



shows what the estimated cost of the gas to the consumer will be and how that price will compete with other fuels.

Q. In that area?

MR. McKINNON: In that area.

Q. Then you ask, under Paragraph 9, particulars of the contract between the applicant and the purchaser of the gas to be removed from the Province.

Now, does that mean defining the contract, showing the prices, the loads and all other terms and conditions?

MR. McKINNON: Yes, if he has one.

Q. Well, if he hasn't got a contract, I don't suppose you are prepared to give him a permit.

MR. McKINNON: Well, we would have to do that possibly on our judgment basis, to determine whether the project was feasible and if we had any doubts in the matter at all we would recommend to the Government, if we decided to issue a permit, that there be a condition in the permit that the applicant had to satisfy the Board, by a certain date, that the project was financed and that they would commence with the construction of a project.

Q. Now, with that material that you have, assuming the contract was filed and you had this information as to the capital and operating costs of



the pipeline and you then had the price that the gas is supposed to be sold for or purchased at the border, say, do you make any inquiries as to whether or not that gas is going to be sold at less than cost at the border?

Mr. McKINNON: That matter has never come up, Mr. Pattillo. I don't know why the gas companies would sell at less than cost.

Q. Well, I will put it to you like this, Mr. McKinnon: I have been instructed that West-coast Transmission is selling the gas at the border in the present line at less than cost. Now, I don't know whether that is so. I am merely saying I have been instructed.

Did you at any time inquire into, with the data you have had in connection with this application, whether or not that was a possibility or a fact?

MR. McKINNON: No, sir, we didn't. I think there is a lot of misunderstanding, at times, when comparing the asked price, Mr. Pattillo, and the load factor at which the gas is being purchased or sold is not taken into consideration.

A. And in determining whether or not this export of gas is for the benefit of the people of the Province of Alberta, you do not make any inquiry as to whether the sale of the gas at such a price might result in the consumer in Alberta being



required, in fact, to subsidize, in part, that sale?

MR. McKINNON: No, I don't, Mr. Pattillo. I think, as we explain in the brief here, we have tried to employ, in our deliverability schedules, those reserves which we think are most economical for the people of the Province.

Q. And is there anybody, to your knowledge, who does make such an inquiry as I have intimated to find out whether or not any Canadian consumer is being asked in any way to subsidize the sale of gas, in part, to the United States?

MR. McKINNON: I think, as far as any consumer in Alberta is concerned, Mr. Pattillo, he can appeal to the Board of Public Commissioners to have his gas rate determined or appealed.

Q. Thank you. Now, then, as to Item 10, "Particulars of the method of financing the proposed facilities," do you require, in connection with that, information to be disclosed as to how much equity capital is to be issued and what is to be received for it; how much is to be issued in the way of debentures or bonds and what is expected to be received for it and that sort of thing?

MR. McKINNON: No. We are particularly interested in the proposed financing from the point of view of how much equity stock will be issued, how much in the way of preferred stock may be issued and what will be done in the way of bonds. We are



interested only from the point of view of being able to determine, with the capital and operating costs, what the price -- at least, what the final cost of operating the line would be. In other words, the difference in percentage between the equity capital and the bonds can make quite a bit of difference in the money that is required to meet the financing costs.



Q. I quite agree, and in making that assessment, and looking at that, do you make any inquiry into the amount of promoter's stock and option stock that is issued below market?

MR. McKINNON: No, we are not interested in that at all, Mr. Pattillo, because when you are preparing an estimated cost of transportation you merely look at it from a gas point of view. In other words, you have a rate base, and the rate base determines what rate of return -- or, at least, the rate base and the rate of return determine the amount of revenue that a pipe line owner may receive.

Q. Yes, but you will agree with me that if you dispose of a good deal of your equity capital at below market prices and you need so much money to finance the operation, it means that your ratio of bonds and debentures is naturally going to be forced up and the amount of interest money that you must earn is going to be increased?

MR. McKINNON: I do not know that I quite follow you there. You see, the rate base is based on, you might say, the cost of the project -- the actual money that was required to build the physical facilities of the project. Now, there might be some additional cost in the way of promotion fees, if you want to put it that way, and legal fees, and so on, and you have to allow for working capital, and that is some of the cost of the project, and your



working capital determines your rate base. Then, so far as the financing is concerned, so much of the money required is financed by bonds and so much by actual capital. The higher the amount of bonds the less revenue the project requires because, as you know, the bond interest is deductible from income tax and the rate of return is always calculated after taxes.

Q. To your knowledge do you know whether there is any person or any body in Alberta that does inquire into the matters that I have just been raising?

MR. McKINNON: Yes, Mr. Pattillo; as I said before the cost of transporting gas within the province, and any rates passed to the consumer, are subject to review by the Board of Public Utility Commissioners, and they inquire into those matters which you are now discussing.

Q. But that would not apply to what I would call an interprovincial line?

MR. McKINNON: No, we would not have the jurisdiction there.

Q. No. Now, Mr. McKinnon, would you care to express any opinion -- because as you will understand from the Terms of Reference of this Commission it is asked to make certain recommendations -- would you care to express any opinion as to whether or not in your view any federal body should be set up to regulate and inquire into these matters which we have just been discussing for interprovincial



companies?

MR. McKINNON: Mr. Pattillo, I would not care to answer that question. I think that would be a matter for the Government to make any representations on.

Q. Thank you. Now, at the bottom of page 63, as I read this, you state that the Board in its interim report in 1951 made the following recommendation concerning the protection of the present and future needs of the people of the Province:

"In view of the most favourable prospects of the Province for the discovery of additional extensive gas reserves and in view of the possibility of the development of alternative forms of fuel and energy, the Board believes that the Province will be adequately protected if sufficient reserves of pipeline gas are provided to maintain the supply and deliverability for thirty years."

And then you say that the Alberta Government concurred in the report, and since that time the 30-year requirement has been adhered to. Now, first, might I ask you about this phrase that appears in what I have read, and having in mind that it was written in 1951 -- and I know we are all wise after the event -- ". . . in view of the possibility of the development of alternative forms of fuel and energy"? Seven years have elapsed. Has the situation, in your judgment and in the judgment of



any of the members of the Board, in any way changed between 1951 and 1958 as to the possibility of the development of alternative forms of fuel and energy?

MR. GOVIER: Mr. Pattillo, I would be glad to offer this comment: If I were re-writing this paragraph today I do not really think I would change it at all.

Q. Well, has the situation changed in the intervening seven years, doctor, as to the advancement towards the development of alternative forms of fuel and energy? Do you think we are any closer to it today than we were in 1951?

MR. GOVIER: I would say exactly seven years closer.

Q. Well, we can only be seven years closer, doctor, if we know when it is going to come about. Is not that so?

MR. GOVIER: Well, Mr. Pattillo, I think there is no doubt that there is today more knowledge as to the commercial possibilities of certain processes for the release of energy than there were seven years ago. I think, perhaps, better guesses as to the timing of full scale commercial operations can be made now than were made seven years ago, but on the other hand, comparing the cost of such sources of energy with fossil fuel energy, it does not seem to me that anyone could at this time make a statement much more definite than the one we made some seven



years ago.

Q. In other words, you do not anticipate from the knowledge that you have that these alternative forms of fuel and energy are likely to bother the natural resources of the Province of Alberta during your lifetime or mine?

MR. GOVIER: I really do not, Mr. Pattillo.

Q. Now, there is one thing I would like to ask about this statement, and it is this selection of the period of 33 years. Was that in any way predicated upon the usual practice in natural gas franchise contracts of having long term contracts of twenty years?

MR. GOVIER: No, sir, it was not. The thirty years was a judgment period of years selected by the Board after much discussion and consideration. I might say that we gave thought to both lesser and longer periods of years, and having regard to all factors we felt that a 30-year period was a reasonable future period to consider.

Q. You do agree, from your knowledge and experience, that it is generally understood that you cannot finance the development of the transmission of gas unless you have firm contracts for a period of approximately twenty years?

MR. GOVIER: I understand that is the case.

Q. Now, what is puzzling me, doctor, is this: Supposing an export permit was given knowing



that the term of the contracts was to be for a period of twenty years, and supposing it was given to some party in the United States, and that a part of the United States became dependent upon the Province of Alberta's natural resources for its well-being, its fuel supply, would it be in the realm of feasibility of discontinuing that on notice because the Board began to think, as a result of developments in the Province which had not been anticipated, that the supplies were needed at home?

MR. GOVIER: Do you mean, Mr. Pattillo, within the period of the permit?

Q. Not only within the period of the permit, but after. In other words, is it in the realm of practical affairs if a community has enjoyed Alberta gas for twenty years that it could be terminated unless there was no longer a supply?

MR. McKINNON: I do not see any reason why it would not. The permit would automatically expire, and when there is a permit granted for twenty years, and there are reserves left in the field or a reserve in the pools supporting that permit, we phase in the balance of the reserves to meet other requirements.

Q. What I have in mind is what I call the development investment; something very similar to that which Dr. Govier was explaining this morning



about the situation down in Turner Valley when he said they reached a compromise agreement because these companies had investments, and they had some right to have some say in how their investment should be developed. What I am thinking of is the substantial investment that can occur over a long term period of twenty years that might be jettisoned, and I am wondering whether it is practical, once you have given a long term contract for that, to terminate it as long as the supply is available?

MR. McKINNON: Mr. Pattillo, our permits specify the total amount of gas which may be removed during the period of the permit.

Q. Yes?

MR. McKINNON: The only way they would be able to get more gas is to make an application either for a new permit or to amend the permit, and if they did ask for additional gas they would have to satisfy the Board at that time that the gas was surplus to the future needs of the people of the Province for the next thirty years at the date the application was made or at the date the application was considered.

Q. Thank you. Now, on page 65 in the first paragraph and the last sentence there is: "With a large proportion of our reserves being wet gas, the ideal way to meet requirements would be to use wet gas for basic requirements and dry gas for



peak loads." Now, I am not sure whether or not it was clear from the material you have given us, but can you give us any indication as to the percentage of the gas in your reserve figures given this morning which would be deemed to be wet gas as opposed to dry gas?

MR. McKINNON: It is about fifty-fifty.



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Q. About fifty-fifty. You say the ideal way to meet requirements would be to use this wet gas for basic requirements. If that was done would there not be a tremendous amount of by-products that would have to be disposed of?

MR. McKINNON: That is true.

Q. And if not disposed of, it would have to be stored?

MR. McKINNON: That is right.

Q. Are there any storage facilities, at the present time, in Alberta for these products?

MR. McKINNON: No, Mr. Pattillo, there are not. I believe one is being investigated at the present time. As a matter of fact, the Board is going to meet with the parties concerned on Friday to discuss its feasibility.

Q. So far as you know, the market at the present time does not exist for these by-products?

MR. McKINNON: There does exist a market for some.

Q. What proportion?

MR. McKINNON: For most of the propane and it would be, probably, about fifty-fifty on the butane, although quite a bit of butane is being re-injected back into the gas caps. I could get those figures for you.

Q. I wonder if you would do that at a later time and file them with the Board? I am



puzzled about this last complete paragraph on page 65. "It is only after trying, by trial and error method, various combinations of the different types of reserves that a final deliverability schedule can be compiled indicating how the requirements of the Province can most efficiently be met and how any surplus reserves can be used to meet the requirements of an applicant for 'export'. Of course, this final schedule can only be illustrative and would be subject to change with the development of additional reserves and changing markets."

What puzzles me is this: if the gas collector enters into a long-term contract with somebody in the United States, for example, I would assume he would, necessarily, enter into an equally long-term contract with local producers and that being the case, I am concerned then as to how this would be subject to change with the development of additional reserves and changing markets?

MR. McKINNON: These schedules are the result of a study. We have to assess the situation at the time we have to make any decision on export. As we have mentioned here, we give preference, of course, to supplying the needs of the people of the Province, but in the course of making these studies we try to determine what, from an economic point of view, is the best for the people of the Province,



and then, having allocated those reserves to meet the requirements of the people of the Province, we then say how the remaining reserves can fit into any export plan.

Q. I follow that, but then, once having made, in your best judgment, that decision and the long-term contract having come into being, so far as they are concerned the situation is frozen for the term of the contracts?

MR. McKINNON: Yes, it would be. I think we are referring more to the local requirements in the change-over. There might be reserves from a closer community that could be used.

Q. Would you look at page 69? We are dealing there with the construction of pipelines and in the last sentence in the first complete paragraph of that page you say: "The Board, after consideration of the application, notifies the Minister, in the case of a gas line, of its approval or disapproval of any changes in the plan or details it deems expedient, and in the case of an oil line, of any objection it may have."

Would you please explain why that distinction is made between the gas and oil lines?

MR. McKINNON: I think that is laid down in the Act; we are merely following the instructions of the Act.

Q. You do not know the thinking back



of it as to why there should be a distinction between a gas and an oil line?

MR. McKINNON: Well, in the case of a gas line it is of direct interest to the consumers here in Alberta. In the case of an oil line the cost and the price of oil are not set in the Province, but are set in outside markets.

Q. I have heard it said it is in Texas.

MR. FRAWLEY: It used to be, anyway.

MR. PATTILLO: Mr. Frawley once tried to find out how they arrived at that. I believe you worked at that for eighteen months, did you not, Mr. Frawley?

MR. FRAWLEY: It was more than that.

Q. On page 71, I wonder if you would explain this for me: you told us, I think you did or perhaps it was Mr. Somerville when he was giving evidence, that so far there has been no declaration that any pipeline owner is a common carrier.

MR. McKINNON: That is correct.

Q. Now, reading from there, page 71:
"Under Section 43, the Board, with the approval of the Lieutenant Governor in Council, may declare a person who purchases, produces or otherwise acquires oil or gas in a pool to be a common purchaser of oil or gas from the pool or pools designated by the Board."

I wonder if you would explain that to me?



I am afraid I am not clear on what is meant by that.

MR. McKINNON: Possibly I could give you an example: you might have a case of a gas pool where a producer there has a market for gas whereas the other producers in the field do not. If he sells his gas he will eventually drain the gas of the other producers as well unless they can find a market. We would make the purchaser of the gas purchase from all producers in the field.

Q. That is similar to the proration of oil?

MR. McKINNON: Something along that line, but this can be done with specific fields or pools.

Q. Has it ever been done?

MR. McKINNON: No, but I think the fact that the suggestion is there has helped arrangements to be made.

Q. May I just go on? "The Board, under Section 46, may, after a hearing, order the owner or operator of a well, gas pipe line or processing plant to process, gather, deliver, buy or sell gas and construct the necessary facilities."

Has that ever been done?

MR. McKINNON: Yes, I think it was done back several years ago, Mr. Pattillo, before I was with the Board. Mr. Goodall may remember the



occasion. I think it was done in Turner Valley.

Q. Do you recall, Mr. Goodall? Could you add to that answer?

MR. GOODALL: Yes, I think that is correct. There was an order made by the Board regarding the gathering and processing of gas in Turner Valley.

MR. FRAWLEY: Mr. Chairman, there is among the exhibits a copy of an address made by Mr. Goodall some time in June, 1957, in which he reviews the early history of the Board and in that there are some of these matters Mr. Pattillo is asking about.

THE CHAIRMAN: Thank you, Mr. Frawley, very much. I noticed that.

MR. FRAWLEY: It is part of Exhibit C in the large binding.

THE CHAIRMAN: It is the first one.

MR. FRAWLEY: The first one.

Q. Now, on pages 74 and 75 you are dealing with classification of reserves, and you have given an outline about the proven reserve and the probable reserves, and then you talk about a reserve determined by the material balance method. Does the Board employ the material balance method?

MR. GOVIER: Yes, sir, the Board does employ this method in the case of any field for which there has been adequate production records



and for which there are adequate statistical records. I do not intend to suggest by that there are no adequate statistical records for most fields. The records are usually very complete. The method, as was indicated before, can only be applied with accuracy to a field from which there has been a fair amount of production.

Q. In making your total figures available in the charts, I must say perhaps I am missing this: do you distinguish between the calculations that are made by this method and the calculations that are made by other methods?

MR. GOVIER: No, sir, we do not.

Q. Is this method the more accurate method?

MR. GOVIER : It is in cases where there has been a sufficient amount of production and where the historical records are sufficiently good. In the case of a gas pool, Mr. Pattillo, it is rather important that there be no evidence of a water drive. To illustrate that: in the Viking-Kinsella gas field; in that case there may be applied a simplified version of the pressure decline calculation and that method is particularly reliable for that field because there is every indication there has been no advance of water in the reservoir. In the case of an oilfield the advance of water can be taken into account with proper data.



Q. If the present situation confronting the marketability of oil from the Province of Alberta should continue, would that in any way affect the probable future reserves of gas?

MR. McKINNON: Do you mean the projected reserves as shown in our statement?

Q. Yes.

MR. McKINNON: Yes, it might, but it might result in fewer wells.

Q. And because of the fact in Alberta so often a person's initial search is for oil rather than gas?

MR. McKINNON: It might be that the companies, of course, depend on their revenue for exploration. I would like to make one thing clear: the total reserves we anticipate finding would affect the rate at which they are found.



Q. I appreciate that, and as to the length of time that might elapse before these 20,000 wildcat wells have been drilled.

MR. MCKINNON: Right.

MR. PATTILLO: Mr. Chairman, if we might have a recess at this moment, and maybe I can go over my notes and shorten it. The Board has been very good and very patient, and I don't want to take undue time.

THE CHAIRMAN: Well, we will recess, certainly, for ten minutes.

---Short recess.

THE CHAIRMAN: May we resume the hearings, gentlemen, please? Mr. Pattillo?

MR. PATTILLO: Gentlemen, may I direct your attention to page 80: we see there a table saying, "Reserves presently considered within economic reach (dealing with gas reserves): 18.3 trillion cubic feet." As I understand it, for the sake of a rough approximation we can assume something over nine trillion cubic feet of dry gas is available in economic reach?

MR. GOVIER: That is correct.

Q. Having regard to the present market of the by-products of wet gas, how much more gas could we add to that nine trillion which could be economically sold at the present time?



MR. GOVIER: I think, first of all, we might just check on the proportion of dry gas. I told you that I agreed with your figure of 9 trillion cubic feet: it would likely be a little more than that because Item 3, the deferred gas, is for the most part wet; but, in any case, I think we should add Item 3 to Item 1 and we would get 19.7, and divide that by two.

Q. Let us call it 10?

MR. GOVIER: Somewhere between 9 and 10.

Q. Well, what I want to get at is, approximately how much more gas could be economically sold at the present time having regard to the present markets for the by-products of wet gas which would either have to be disposed of or stored?

MR. GOVIER: Well, you appreciate the fact that the figures we are discussing are reserves. They are not daily production.

Q. I agree, but we have got reserves, and let us say we decide to sell them right now.

MR. GOVIER: In that case, my answer would be that we could, on your hypothesis, sell the 18.3 trillion cubic feet.

Q. Just let me see we are not at cross purposes.

MR. GOVIER: We may well be.

Q. As I understand, the wet gas, in order to be sold, has to be broken down and you have



the by-products, and you have to get rid of the by-products; you have either got to store them or put them in use or sell them?

MR. GOVIER: That is correct.

Q. Now, we have agreed that 10 trillion would not be concerned with that problem at all?

MR. GOVIER: That is correct.

Q. The other 10 trillion would be. Now, we have present markets for some of those by-products, and we might possibly store some -- Mr. McKinnon says there is consideration being given to a storage scheme -- and we can put some in use, putting it back for recycling?

MR. McKINNON: Maybe I should clarify that statement I made about storage. There are some storage schemes at the present time for butanes. The storage scheme I was referring to was for propane; but, butane is being stored in the gas tanks of some fields.

Q. What I would like to get at, doctor, and I know you cannot give it to me exactly, but can you give me some rough estimation of how much of that 10 trillion wet gas one could economically dispose of at the present time having regard to the markets and use that can be made of the by-products?

MR. GOVIER: I would think, Mr. Pattillo, a very high proportion of it could be disposed of,



assuming that the producer was able to sell it at a price where he considered it attractive to reinject the liquid product for which he had no present market into the reservoir. The answer to your question really depends on the amount of revenue the producer would receive for the sale of gas.

Q. For the dry gas?

MR. GOVIER: If it was sufficient, he could cheerfully defer revenue from the liquid products, but if it was insufficient it may not be attractive for him to sell it.

Q. Let us take it on the basis -- what are the going prices today as known to you and known to me for gas, prevailing in the Province of Alberta?

MR. GOVIER: Is that a question?

Q. I say, taking those figures of mine ---

MR. GOVIER: Well, I would prefer only to go this far: that I believe a relatively high proportion of the wet gas could be processed and marketed, assuming the producer received an attractive price for the residue gas therefrom. I don't believe I can go much further.

Q. All right. The next question I wanted to ask you was, am I correct in thinking that you figure that at the present time the requirements for the Province of Alberta are in the vicinity of 7 trillion?

MR. GOVIER: It is very close to that figure.



I don't have the exact figure handy.

MR. COOPER: The present figure for a 30-year requirement, starting with 1957, was 7.6 trillion. However, in view of the fact that 1957 has now gone by the board, and we are looking at it a year beyond, it would approximate 7.8 trillion cubic feet.

Q. These figures that are here, I assume, cover the quantities of gas that have been contracted to be sold but have not yet been delivered, such as the quantities of gas which have been contracted to be sold to Trans-Canada over a period of time, and the quantities of gas that have been contracted to be sold to Montana, and the quantity contracted to be sold by Westcoast to Pacific North West?

MR. GOVIER: That is correct. The figures which appear on page 80 include all gas now in the Province.

Q. Can you tell me approximately the quantities that have been contracted to be sold out of the Province by those companies?

MR. McKINNON: They are tabulated on page 61. The only definite amount not shown is that in connection with Canadian Montana Pipe Line Company, but possibly the staff could add up their present reserve estimates to give you a figure to add to the 5.95 trillion shown as authorized on the last



column of page 61.

MR. MACLEOD: I think the 5.95 trillion includes 273 billion for the Canadian Montana.

Q. That is approximately 6 trillion, is that correct, that is contracted out at the present time?

MR. COOPER: That is right.

Q. So that on these figures at the present time, taking 20 trillion to start with, and there is approximately 6 contracted out; that is 14 left, and of that you approximately require half for the Province, so that that would leave approximately 7 trillion; am I correct in my mathematics?

MR. GOVIER: Your mathematics is excellent, but the inference is not correct. I am sorry, sir; I am not trying to be facetious.

Q. That is quite all right. You tell me wherein I am wrong.

MR. GOVIER: There is a very important point involved here, sir, and that is that if we take the 30-year requirements for the Province of Alberta as somewhere around 7.8 trillion cubic feet, what is meant by that figure is that in 30 years some 7.8 trillion cubic feet would have to be supplied to the markets in the Province. That gas can only be supplied if there is gas left in the reservoir to push it out, and that is what we refer to as the deliverability program. It means that in the thirtieth year



there must be sufficient gas remaining in the gas fields connected to the Alberta market to give an adequate field pressure so that on a cold winter day there can be enough supplied to all Alberta consumers; and in very round figures -- and this is quite a crude approximation -- it means an additional 4 trillion cubic feet of gas would have to be in the ground on that thirtieth year. In other words, to meet the 7.8 trillion cubic feet Alberta requirement we really must set aside somewhere over 12 trillion cubic feet of gas. So, if you use the figure of 12 instead of 7.8 in your calculations, the inference would then be correct, although I should hasten to say too that the export markets, if they were to continue to be served, which may be the case on the renewal of a permit, as the Chairman referred to, then cushion gas would be required for them.

Q. In somewhat the same proportion?

MR. GOVIER: More or less -- no, it would be a lesser amount of cushion gas in proportion to the export because the export load factor is so much higher than the internal load factor.

Q. Is the internal load factor at Edmonton very similar to the internal load factor you expressed at Calgary?

MR. GOVIER: It is well known the weather at Edmonton is much better than it is at Calgary.



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I just asked that question to give you an opportunity to bring that out, Doctor.

Now, at the present time, as I understand it, the Board is not concerned with the price that the producer of gas may be able to obtain for his product in negotiations with a pipeline distributor or any other possible purchaser?

MR. GOVIER: That is correct. We have no responsibilities in regard to the price of gas.

Q. And you are not in any way concerned with the price that is being acquired for the sale of oil, a barrel of oil at the wellhead?

MR. GOVIER: That is correct; we have no responsibilities there, either.

Q. Have you any way, from data that is in your possession, of working out how the producer of oil and gas in the Province of Alberta is faring today, having regard to the present prices which are being paid for the barrel of oil and the cubic foot of gas and the costs of drilling, the acquisition costs and other expenses?

MR. McKINNON: We have a list here of competitive posted prices, comparative posted prices in Alberta, Saskatchewan, Manitoba, and in some of the United States, if you would be interested in hearing them.

Q. We would be interested.

MR. McKINNON: Mr. Cooper, if this list that



I give is not up to date, would you let me know?
The latest I have is in the little book you provided.

MR. COOPER: There have been some minor changes in the Saskatchewan posted prices.

MR. McKINNON: Leduc Woodbend, 39 gravity, crude, \$2.74 a barrel as the posted price.

Joarcam North, 37 gravity, \$2.60; Redwater, 35 gravity, \$2.63.

I may say that Redwater is used as a standard for comparing the other crudes, as 35 gravity crude is very often used as a basis for comparison. It is also from the largest reserve we have.

Stettler, 28 gravity, \$2.23; Wizard Lake D-2 and D-3, 38 gravity, \$2.71½; Bonnie Glen, 40 gravity, \$2.83; Pembina, 38 gravity, \$2.61; Turner Valley -- is that the 53?

MR. COOPER: 53.

MR. McKINNON: What is the gravity?

MR. COOPER: 33 and 33.9 degrees.

MR. McKINNON: \$2.55. Now, the Saskatchewan prices, I believe, have been revised recently. Possibly, Mr. Pattillo, we could furnish you with the information on those later.

MR. PATTILLO: Thank you.

MR. McKINNON: The American prices we have are Mid-Continent, 36 gravity, \$3.07; North Dakota, 36 gravity, \$3.07; Illinois Basin, \$3.15.



I have not got the gravity. It is a flat price.

Wyoming, 36 gravity, \$3.00; Texax Gulf, Upper and Lower, 26 gravity, \$3.07 to \$3.22; East Texas Field, \$3.25. I haven't got the gravity on that.

Signal Hill, 21 gravity, \$2.93; Oficina Crude at Puerto la Cruz, 35 gravity, \$3.05; Middle East, Arabian Crude, 36 gravity, at Sidon, \$2.69 and Arabian, 34 gravity, at Ras Tanura, \$2.08.

You can see, Mr. Pattillo, from that comparison that the prices of crude at the wellhead in the United States are, in all cases, higher, even when you take the gravity consideration, than when you take the Canadian gravity prices.

MR. PATTILLO: Q. Now, have you ever made any analysis of the comparative costs of the discovery development in lifting in Alberta vis-a-vis the States?

MR. MCKINNON: We haven't, Mr. Pattillo. I imagine industry could give you those figures. I would say, though, that I think the costs here would be greater here than in the United States because of the extra cost that has to be paid here for equipment and also for winterizing.

Q. Dr. Govier, would you mind expressing your view about this question: it has been suggested to me that, having regard to the general uplift of the domestic estimates as shown in the chart to



which you referred this morning of reserves of gas, that it might be reasonable to say that the probable recoverable ultimate reserves would be closer to the upward figure of 83 trillion than it would be to the minimum figure of 60 trillion as shown in the Board's report.

Would you care to express any view on that?

MR. GOVIER: Yes, sir, I agree.

Q. Now, on page 27 of the brief, and again at pages 34 and 40, comments and references are made to the words "waste" and "wasteful operations."

Would one of you gentlemen comment on the significance of the changes in the definition of "waste" that was made in the Act in 1957?

MR. GOVIER: Mr. Pattillo, I wonder if it might not be appropriate for us to ask the Board's solicitor, Mr. Macleod, to give you a comment on that question. I believe it would.

MR. PATTILLO: Yes.

MR. GOVIER: Are you in a position to do that now, Mr. Macleod?

MR. MACLEOD: I haven't got a copy of the previous Act with me for the purpose of comparison, but there were two main changes and I could give those to Mr. Pattillo and, if he wants further information, I can expand on it.



MR. PATTILLO: Thank you, Mr. Macleod.

MR. MACLEOD: One of the changes was to split the definition of "waste" into two definitions, that of "waste" and "wasteful operations".

Everything that is in "wasteful operations" under the old definition, subject to what I have to say later, each of those wasteful operations would be defined as "waste", but that, grammatically, made for a very long and grammatically unsound definition that was difficult to follow and, in order to get a better and more clear definition, it was found convenient to split it.

The other change is that under the clauses of "wasteful operations" there are a few additions to the things listed there and that was to cover those additions. The additions were made more or less so that "wasteful operations" would cover almost every type of operation that was mentioned subsequently in the Act as subject to regulation.

Now, if the Commission or Mr. Pattillo would care to have it, I will make a more complete analysis and submit it later.

MR. PATTILLO: I think that is sufficient for our purposes, thank you, Mr. Macleod.

Q. Now, would one of you gentlemen tell us what is meant by the term "economical waste"?

MR. GOVIER: Well, I will take that on, Mr. Patillo, not because I can give any pat answer;



I am afraid there isn't one.

We use the term in the Board as referring to waste which can economically be avoided. I think, perhaps, I can illustrate it best by giving you the illustration of a kind of waste which I would not consider economical waste.

Suppose, for example, there should be gas flared at an oilfield and one would be tempted to say there was gas being wasted. However, suppose, on analysis, it was determined that it would cost 50¢ per MCF to gather the gas and to bring it to the point where it was worth 15¢ per MCF. Under those conditions, the Board would not class the waste as economical waste.

Q. Thank you. Now, in view of the present market situation for oil in the Province of Alberta, where approximately only 50 per cent. of the allowable is being marketed, has the Board given any thought to, and would it be feasible to consider prorating development drilling in any manner?

MR. McKINNON: What do you mean by "prorating development drilling", Mr. Pattillo?

A. Well, you have got me; but I would think that what the person who framed this question had in mind was that at the present time you are prorating the oil that is available for sale, in accordance with the formula explained. Now, I suppose what we are saying is that instead of a



driller coming before the Board with an application for a license to drill and bringing the map in that only so many licenses would be granted over certain areas, or something of that nature.

MR. McKINNON: Mr. Pattillo, that would be very difficult to do and it might be unfair to curtail development drilling where you are denying a fellow his right of a chance to obtain his oil and somebody else, in the meantime, would get it.



Q. Thank you. Mr. McKinnon, can you tell me whether the Board has available any information which it can file or give us as to the success rate of wildcat wells known to have been drilled mainly or specifically for gas?

MR. McKINNON: It would be very hard, Mr. Pattillo. We might by examination of some of the applications for licences -- they might state on there whether they expect to find oil or gas; generally it is both. I do not think we could provide that information with any degree of accuracy, Mr. Pattillo.

MR. PATTILLO: Thank you. Those are all the questions I have, gentlemen.

MR. FRAWLEY: Mr. Chairman, I would like very much to have the indulgence of the Commission to reserve, until I have read the transcript, any re-examination I may have, and to consider whether I want to re-examine at all.

THE CHAIRMAN: Certainly you may do that, Mr. Frawley. We will get the transcript this evening, I take it.

MR. FRAWLEY: That is right. The Board is not sitting tomorrow.

THE CHAIRMAN: We could sit tomorrow.

MR. FRAWLEY: I would not ask for a special sitting, and if it would not run into the time fixed for other briefs on Friday I think that whatever few questions I have, if any, could be taken care of on



Friday.

MR. MCKINNON: Mr. Frawley, the Board will not be able to attend here on Friday.

THE CHAIRMAN: The Commission is quite willing to suit your convenience tomorrow morning, sir.

MR. FRAWLEY: It is the Board I have difficulty with. Well, I have no questions at the moment, and it might turn out that I will not have any at all.

THE CHAIRMAN: Would you like us to schedule a meeting tomorrow?

MR. FRAWLEY: No, I would not like to ask that, sir. To make my position quite clear, I would like to read that transcript to see whether, even by implication, there is anything at all I would like to clear up, and if I find there is anything important to warrant my asking any questions I can notify Mr. Pattillo and then, if necessary, I might ask to have a special sitting.

THE CHAIRMAN: We will do our best to suit your convenience.

MR. PATTILLO: Mr. Macleod, do you wish to ask any questions?

MR. MACLEOD: I have one or two I would like to ask for clarification, but before I do that I would like to make a suggestion with regard to Mr. Frawley's questions. If he wishes -- it might be more convenient when he knows the questions he wishes to ask if he would write the questions and we could



have the Board table a reply without having to have a special session. Perhaps that might be agreeable to all concerned. I have only one or two questions.

The first question or two I have deal with the field operations and field inspections. Do the Board actually run tests themselves or do they just attend at the making of tests and supervise them?

MR. GOODALL: the Board does not run pressure tests, but it does have an observer there to see that they are taken according to the proper methods. As far as secondary pressure tests are concerned, the Board has its own equipment and it does run some secondary flowing pressure tests.

MR. MACLEOD: Thank you. Does the Board operate any producing wells in the Province?

MR. GOODALL: Yes, it has one well in Turner Valley.

MR. MACLEOD: In connection with matters outlined on page 42 in the chapter dealing with secondary recovery there are listed groups of factors that determine the fraction of the initial oil in place which may be obtained, and under Figure 4, Method of Production, one of the factors listed there is the spacing of wells. Is the spacing of wells an important factor in determining the extent to which the oil in place is recovered?

MR. GOVIER: Mr. Macleod, within the range of well spacing that is ordinarily used in the



industry spacing itself does not have, or is not thought to have, very much effect on ultimate recovery, but, of course, it does have quite an effect on the period of years over which the oil recovery may be obtained.

MR. MACLEOD: Would that answer, Dr. Govier, have any bearing on the question that was asked this morning regarding the views of the Board with regard to the tendency towards wider spacing? In other words, that was referring, I believe, to the part in the submission that said the Board had agreed with industry that wider spacing was often desirable.

MR. GOVIER: I see your point, Mr. Macleod. The thinking on the effect of spacing on recovery which I have referred to does, indeed, have an influence on both the Board's and industry's attitudes on spacing because it is generally thought within a reasonable range of spacing spacing does not affect recovery, and, therefore, the problem of spacing ultimately becomes one of an economic balance. The oil or gas may be obtained more quickly with more wells and at a greater cost and at a greater present worth, but on the other hand the present worth may, and often does, result from wider spacing involving a slower recovery but lower cost.

MR. MACLEOD: Thank you. Turning now to Appendix M, near the middle of the first paragraph



on the first page there is a statement that the increase in new reserves during 1957 amounted to some 283 million barrels, of which some 66 million barrels is attributable to newly discovered pools or fields. What makes up the balance of this increase?

MR. GOVIER: The balance is due to the extension of previously discovered pools or fields, and revisions in some instances.

MR. MACLEOD: Thank you. Dealing now with gas reserves I have a question with regard to surface shrinkage. That includes, I understand, gas used for lease operations, does it not?

MR. GOVIER: That is correct.

MR. MACLEOD: Does it also include gas required in the operation of a plant in the field?

MR. GOVIER: No, sir, it does not. Any gas that would be required for the operation of a processing plant -- that is, for the fuel requirements of a plant -- is not deducted from the reserves. I might just check with Mr. Stabback on that point.

MR. STABBACK: I am afraid you are not correct, Dr. Govier. Both requirements are deducted. Surface losses are made up of lease fuel requirements, plant fuel requirements, and processing shrinkage.

MR. GOVIER: I stand corrected, Mr. Macleod. Did you hear Mr. Stabback's answer?

MR. MACLEOD: Yes.



MR. GOVIER: I agree with that.

MR. MACLEOD: In discussing the oil in gas in one of these earlier chapters there is mention made of condensate. Sometimes in reading about refinery requirements and what is used in the refining of the raw product we see reference to "distillate", and that might occur in some future submission, and I thought possibly it might be useful to the Commission if you could tell them what distillate is, and if there is anything to distinguish it from condensate?

MR. GOVIER: The term "distillate", as I understand it, is used in two different senses. Most commonly it is a term used by refiners to refer to either an intermediate or a final product recovered from the distillation of crude oil. Occasionally, however, I have heard the term used as related to production in a sense virtually synonymous with condensate. The Board does not use the word "distillate" in the latter sense at all. In fact, we seldom use the word. I do not recall whether "condensate" has been defined before, Mr. Macleod. Would you like me to define that at the same time?

MR. MACLEOD: Well, if you would, please, Dr. Govier.

MR. GOVIER: "Condensate" refers to the liquid hydrocarbon which is like crude oil, and may well be the equivalent of crude oil, which is recovered as a result of fuel separation operations.



It is not recovered in a processing plant; it is recovered in a simple fuel separator as a liquid.

MR. MACLEOD: Would that include, say, the trap in a pipe line?

MR. GOVIER: I am not sure, Mr. Macleod.

MR. MACLEOD: Thank you, Dr. Govier.

Those are all the questions I have at this time. I would like to ask the same indulgence as did Mr. Frawley, and if anything should be observed later it might be desirable to clarify it, and if so I would like to be given the opportunity of doing so, but I think that pretty well covers any questions I have now, or will have.

THE CHAIRMAN: Thank you, Mr. Macleod.

Would you get in touch with us after you have had a chance of going over the transcript, and we will go through Mr. Frawley's points of view, and your own, because if there are questions and answers, even if they are in writing, we want to get them officially onto the record.

MR. MACLEOD: Yes, sir. Thank you.

THE CHAIRMAN: Have you any further questions, Mr. Pattillo?

MR. PATTILLO: I have no further questions, and I have not been asked by anybody to put any further questions other than the ones that I have put, so unless the Commission wants to ask some questions that concludes the examination.



THE CHAIRMAN: Mr. McKinnon, I believe you did have with you in that little black book a list of the posted prices for oil in Saskatchewan prior to the last change. Is that there?

MR. MCKINNON: Yes.



HH THE CHAIRMAN: I wonder, if, as a matter of interest, even though you are going to give us the later ones, if you could give us those changes and tell us when they took place?

MR. McKINNON: Mr. Cooper, when was the change made?

MR. COOPER: I do not remember the effective date, but it was just recently revised.

MR. McKINNON: The prices we have now are Coleville, 13 gravity crude, \$1.57. Smiley, with no gravity, was \$2.40. Frobisher, with 39 gravity, \$3.77½. Eureka, with no gravity, \$2.52. Steelman, no gravity, \$2.66½.

Mr. Cooper, do you recall which of these were changed?

MR. COOPER: I believe the Steelman price was changed. I am not sure of the others.

THE CHAIRMAN: Do you recall whether they were changed up or down?

MR. COOPER: I believe there was an upward revision.

MR. McKINNON: There are two prices for Manitoba, sir. You might have those: Virden with 33.8 gravity, \$2.55. Daly, with no gravity, \$2.46.

THE CHAIRMAN: Those figures, the posted prices you have given us, it is evident in practically every instance they are substantially lower than foreign oilfield prices.



MR. McKINNON: They are certainly lower than those prevailing in the United States today.

THE CHAIRMAN: I mean the United States, yes.

MR. McKINNON: I would also say they are lower than the Venezuela prices. If you compare the Oficina price, which is 35 gravity, with Red-water, which is also 35 gravity, there is a difference of 42¢.

THE CHAIRMAN: Can you tell us, in general, how those prices are determined?

MR. McKINNON: Western Canadian oil prices are geared to the prices of oil at Sarnia. In other words, they have to compete with Illinois and Mid-Continent crude which could be laid down at Sarnia and, as you know, there is no import duty charged back on crude oil imports so that the price which is determined at Sarnia must be competitive with imported crudes to determine what the wellhead price will be here. From the Sarnia prices you have to deduct the cost of gathering the oil in the field and the cost of taking the oil to Sarnia. That is how the prices are calculated.

THE CHAIRMAN: Gentlemen, have you any questions?

MR. COMMISSIONER CUSHING: Yes, Mr. Chairman, I have. Our counsel, Mr. Pattillo, developed the figures on page 61, that is the permittee pipe



lines and the figures on page 80 as to the reserves presently considered within economic reach. My simple arithmetic arrived at 12 trillion feet for the Province's needs for the next thirty years, and 6 trillion in permits for the pipelines which totals 18 trillion, and I arrive at the conclusion that if there is no further exploration at the present time there is no gas for export purposes. Am I in the same position as the Board?

MR. GOVIER : Mr. Cushing, there are several points I would like to mention in connection with your analysis. First, I do remind you that these estimates are those that have been prepared by the Board staff. They have been prepared before the Board has had the opportunity of hearing all of the testimony on gas reserves which will be presented by the applicants. The figures are, therefore, subject to revision either way. The second point I would mention, is that the 12 trillion both you and I have used as being necessary to protect Alberta's position is, too, a rather rough figure. I used a crude rule of thumb to arrive at it and I, actually, believe the figure will be somewhat under that.

The next point is the 1.4 trillion cubic feet mentioned as item 3 which would not be subject to deferment for a period as long as 30 thirty years, or for a good part of it. I would suggest that



almost all of it might well be available within the last 10 to 15 years of the 30-year period. I think the only conclusion that one should come to from these figures, at the present time, is that there probably is some surplus of gas over and above the present requirements of Alberta and present export commitments, but we are not in a position to pinpoint the number at this time.

MR. COMMISSIONER CUSHING: I notice you made it very emphatic that this is a staff estimate and not a Board estimate.

MR. McKINNON: That is correct.

MR. COMMISSIONER CUSHING: You wish to have it on that position at this moment?

MR. GIVIER: That is correct.

MR. COMMISSIONER CUSHING: The matter of oil in Exhibit G, the opening page, which is an annual review of the oil and gas industry and the introduction deals with world reserves, North American reserves, Canadian reserves, and so on. Is this the view of your Department only, or is there some source of the information provided here? I am thinking, for example, of the Dominion Bureau of Statistics?

MR. McKINNON: Some of the information does come from the Bureau of Statistics. The analysis is made by Mr. Cooper, the statistician.

MR. COMMISSIONER CUSHING: The other question I have deals with the matter of prices in



connection with the production in this Province over the last three years in which it dropped considerably in 1957, and I am wondering if the Board has any information as to why there should have been a rather serious reduction in 1957 in Alberta oil production. I think the 1956 figure is 393,195. The 1957 figure is 376,000, which appear on page 78 of your submission. Since prices are fairly comparable and Alberta prices, it has been pointed out, are considerably less than the United States prices, why is there a reduction in production between those two years?

MR. McKINNON: Sir, there was a big reduction in the demand for Alberta oil in the last six months of 1957. The reason for this, apparently, was the building up of surplus stocks not only in Canada but in the United States. The increased demand that had been anticipated for 1957 did not materialize. In the early part of the year, while the Suez crisis was on, everybody was trying to get as much oil as they could. I would just like to give you some comparative figures in the demand for the different months during 1957. In the month of January the demand was 441,842 barrels a day. In the month of November it was 279,628 barrels a day. In December it was 297,000. We have been trying to find out the exact reasons for the big drop in demand, particularly as in the case of November. We found



that when the nominations were filed for October requirements to give us the estimates for the succeeding three months, as I recall, the figures that were given during the hearing for the October demand were about 80,000 more than was actually asked for in the hearing to determine the annual allowable, and the only explanation we could get was that everybody had a surplus of crude oil and products. Of course, after the Suez crisis was over, we lost shipments by tanker from Vancouver which, at that time, were going to California. There was also a serious curtailment of the requirements in the Northwest Pacific area on the United States, and quite a serious drop in the Eastern, at least, the Ontario market. If the Commission would like to have this information, I could file with them the statement that I am reading from which shows a comparison of years in Alberta's production and the markets to which this production went.

THE CHAIRMAN: Yes, we would like to have it, Mr. McKinnon, if you would be good enough to do that.

MR. McKINNON: We would be glad to do that.

MR. COMMISSIONER CUSHING: We do not have the figures for Saskatchewan before us, as yet, for 1957, but but the same pattern apply in Saskatchewan as applied in Alberta?

MR. McKINNON: No, sir. According to the



information I have, and there are some figures for November and December, the estimated figure for Saskatchewan production for 1957 was an average of 105,000 barrels a day as compared with 57,597 barrels a day in 1956. There is no proration for market demand in Saskatchewan.

MR. COMMISSIONER HOWLAND: I have just two minor questions, Mr. McKinnon: It is obvious you prefer to take a pretty conservative attitude towards your reserves in estimating them, if I am correctly interpreting the figures in some of your projections.

MR. McKINNON: We try to be realistic.

MR. COMMISSIONER HCWLAND: May we take it that you are adopting the same attitude when you are making reservations for future use in Alberta; and I have in mind, in particular, the basic requirements of the Province for industrial purposes.



MR. McKINNON: You think that our estimate may be on the low side?

MR. COMMISSIONER HOWLAND: No. I would like to have from you just what type of estimate you have made. Have you tried to be on the liberal side in making full allowance?

MR. McKINNON: We have tried to use our best judgment with the data we have on hand and with the experience factors that were used in other places.

MR. COMMISSIONER HOWLAND: The second question is, on this "Maximum Efficient Rate" would you be good enough to turn to page 28. I have been trying to understand the formulae, and I have got some concepts through my head, but I cannot quite get the term "sound economics" that you talk about here on the Maximum Efficient Rate. You told us today during the sittings that it did not refer to market matters. Am I right in assuming also that it does not refer to the factors which determine that economic allowance? Just what are these economic factors which enter into calculating an MER?

MR. McKINNON: From an economic point of view?

MR. COMMISSIONER HOWLAND: Yes, the sound economics which you refer to here: what are those factors?

MR. GOVIER: Mr. Howland, I will be glad to try to answer that question. I assume you have specific reference to the second sentence on page 28



in the first complete paragraph?

MR. COMMISSIONER HOWLAND: Yes.

MR. GOVIER: The expression "consistent with sound economics and good reservoir engineering practice" is used there. I am not sure that we have expressed ourselves particularly well, but what was meant was this, that the MER is the maximum rate at which oil wells or the entire oil pool could be produced with an economic number of wells drilled, and using economic and reasonable methods consistent with good engineering practice. In other words, it is the maximum rate which can be economically achieved without reservoir damage. The reference to "economic" there does not relate to an economic allowance or anything like it.

MR. COMMISSIONER HOWLAND: "Economics" in the sense of minimum cost in this case, is it?

MR. GOVIER: Not minimum cost, but rather reasonable and proper costs. I think you can see that if there were no reference whatsoever to economics it may be possible at very large cost to produce a well at a high rate without doing reservoir damage, by replacing reservoir energy, on some very costly basis. That would not be an MER.

MR. COMMISSIONER HOWLAND: I think I am just so ignorant about the subject that I am reaching for a minimum economic factor. I think that must be because of my economic training.



MR. GOVIER: Well, another point involved here is the life of the entire project. Presumably, with very closely spaced wells one might get an MER for the entire pool to be a very high number. The project may have a short life just because of such a high withdrawal rate, but that high withdrawal rate would have to be below the volume which could cause reservoir damage.

MR. COMMISSIONER HOWLAND: Thank you, Dr. Govier.

MR. COMMISSIONER HARDY: I have one question, and I think this has really been answered in a number of ways, but I would like to ask Dr. Govier if, on a straight mathematical point of view, the extrapolation of curves such as M.5 and the extrapolation of M.7, if you are incorporating your safety factor, as it were, in the extrapolation? You are not making the best mathematical extrapolation? In other words, you could not apply to your estimate a plus or minus tolerance of the same amount. Your tolerance is all plus, isn't it?

MR. GOVIER: I think I would have to agree with that statement, Dr. Hardy. In both our estimates of oil and gas reserves we err, where we err, on the side of conservatism and not on the other side. If one were to ask me to assign plus or minus tolerances on the figure of 21 trillion cubic feet, I would have to say I don't think the established



reserves of gas would be any less than that, but that I did think they could be 30 per cent more than that. So, as you correctly put it, it is all on the plus side.

MR. COMMISSIONER HARDY: Dr. Govier gave Mr. Pattillo a very clear definition of millidarcy this morning, and I was wondering if Dr. Govier would agree that Mr. Pattillo could properly deduce that the unit of the millidarcy is in centimeters per second per atmosphere.

Well, we can take it up later.

MR. GOVIER: It is, sir, if you assume it applies only to water.

MR. COMMISSIONER BRITNELL: The first question I have refers to page 78, paragraph 2, on potential production and actual production of oil and gas. I wonder whether some member of the Board would comment on the present sum of MPRs and MERs for Alberta's oil wells and pools which are approximately, I gather, 787,000 barrels a day, and indicate the degree to which this is really a conservative figure? Also -- and this is related -- whether this figure could be increased by the application of efficient, economic, secondary recovery by pressure maintenance techniques should the demand for Alberta's oil increase sharply?

MR. MCKINNON: I think the figure is conservative, but I would like Dr. Govier to comment on it.



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MR. GOVIER: I am sorry, I just forget the first part of your question, and I did want to answer it first.

MR. COMMISSIONER BRITNELL: Well, put it this way: would some member of the Board comment on the present sum of all MPRs and MERs for Alberta's oil wells and pools which are approximately estimated at 787,000 barrels a day, and indicate, if possible, the degree to which this may be regarded as a conservative figure?

MR. GOVIER: Yes, I have your question now. The 787,000 barrels a day results just from arithmetical addition of the MERs and MPRs set for all the wells and pools in the Province. I don't believe we would consider it either conservative or the reverse. It is the sum of the actual MPRs and MERs that have been set to date. In the case of certain pools it does reflect beneficiation due to secondary recovery techniques. In the case of other pools, where secondary recovery methods have been instituted but not yet really proven, it does not reflect any beneficiation, and I think it would be fair, therefore, to deduce that within a period of perhaps even a few months this figure will be increased, as good results are obtained from some of the recovery stimulation processes. Does that answer your question, sir?

MR. COMMISSIONER BRITNELL: Yes, I think so.



My other question refers to page 79, ultimate oil and gas reserves. Reference is made there to the ultimate oil and natural gas potential of the Province, and the figure for Alberta's ultimate reserve of 15 billion barrels is shown. Sixty to eighty trillion feet of natural gas is also estimated as being the ultimate reserve potential of the province. My question is, do these really represent limits particularly if the prices of oil and of natural gas should rise, or, alternatively, if the techniques of exploration and development and production should improve, and therefore lower the cost factor?

MR. GOVIER: No, sir, they should not be considered as limits having regard to those two factors. The figures of 15 billion barrels and 60 to 80 trillion cubic feet of gas should be considered as just order of magnitude estimates of the oil and gas that we may reasonably expect to find on the basis of present technology and present methods and present prices. The figures will undoubtedly be greater.

MR. McKINNON: If Alberta got the same price for gas at the wellhead which they get in Ontario, which I understand is well over 30 cents, it is quite possible you may be able to produce gas down to a much lower abandonment pressure than we have used.

THE CHAIRMAN: Is there any expectation



of getting such a price?

MR. McKINNON: The producer here can always hope.

THE CHAIRMAN: There is one simple little question: when you estimate production on an annual basis, is it a 365-day year that you use?

MR. McKINNON: Yes.

THE CHAIRMAN: Again, I want to express the appreciation of the Commission, Mr. McKinnon, to you and your fellow members of the Board and staff for the most wonderful help that you have been to us and the excellent cooperation that you all have shown to us not only today, but in answering questions and giving us information. Thank you very much on behalf of us all.

We will adjourn now until Friday morning at 9.45.

---Whereupon the hearing adjourned at 4.30 p.m. until Friday, February 7th, at 9.45 a.m.

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